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"World" Readers Respond

THE following, from a letter sent to the ELECTRICAL WORLD by LeVerne Beales, chief statistician for manufactures, sums up the present status of the 1927 Census of Central Electric Light and Power Stations. This work cannot be completed until *every* reply is in. Industry statistics are important. ELECTRICAL WORLD readers are evidently responding. Blame for delayed publication rests squarely on the laggards:

The tearing from the ELECTRICAL WORLD containing the article entitled "Census Data Needed" [editorial in the issue of June 2] reached me a week or two ago and I have been holding it until sufficient time had elapsed to enable me to gain some idea as to its effectiveness. I find there has been an appreciable increase in the receipt of returns since the article in question appeared, and I take pleasure in passing the information along to you.

From present indications, however, it will be a long time before the canvass is brought to completion, and therefore the industry must not expect any preliminary reports in the near future.

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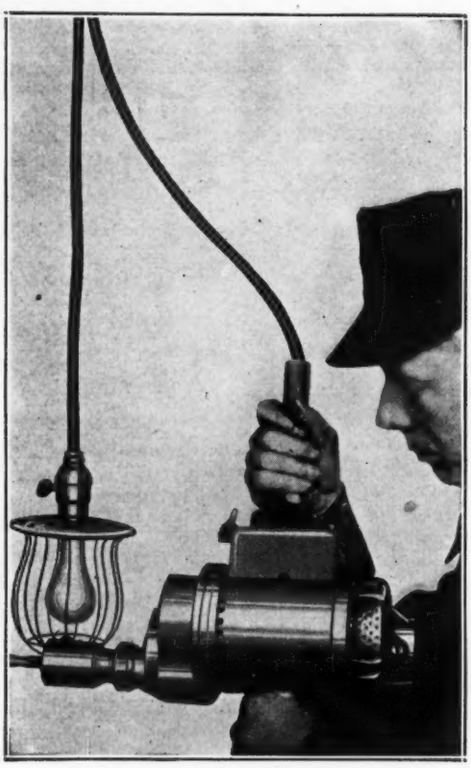

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VOLUME 91 — *New York, Saturday, June 23, 1928* — NUMBER 25

Dramatizing a Convention

WITH a program dramatized and animated throughout the Pacific Coast Electrical Association staged at Pasadena, Calif., last week one of the most successful conventions in its twelve years of existence. Routine matters had been handled during the year, leaving the time of the convention for consideration of new subjects with little time wasted on rehashing of old problems.

Innovations were many. Recognizing that men are becoming more and more "eye-minded," most of the subjects presented were animated by the use of pictures, slides, graphs, charts, apparatus, playlets and pantomime. Dramatization aided in brightening many topics usually found dry, and long sessions were interspersed with music. President-elect Arkwright of the parent body, who had traveled across the United States to attend the convention, spoke most enthusiastically of the whole program arrangement and said that as a result of what he had seen he would make a change in his preliminary plans for the national convention of 1929 and would adopt many of the features of the California assemblage. President W. L. Frost of the Pacific Coast Electrical Association and those who assisted him in arranging the program are to be complimented upon the outstanding success scored at Pasadena.

* * * *

—— *and Into the Fire*

THE annual release of thousands of youngsters from their preparatory years of college life and their assimilation by industry and the world of reality is again at hand. The traditional college man is as rare an individual as the typical business man, for, like all "types," accepted characterizations approach calumny. The recent graduate is eager, ambitious, energetic, overconfident and, in general, exceedingly impatient of delayed recognition of his unproved talents. Such qualities are not those at which one may justly scoff. The somewhat gleeful initiation of the newcomer by the employer into the much overrated school of hard knocks is a doubtfully judicious appreciation of the high, if immature, qualities of youth.

Electric light and power companies have evolved several methods for the training and development of young engineers, but any plan which fails to keep the youngster's time fully employed—which fails to allow an outlet of activity for his energy and desire to do—is an exceedingly poor one. Idle hours and no assigned duties are destructive in the extreme, especially to men fresh from recent intensive mental activities. Responsibility cannot be thrown on untried shoulders, older employees cannot be sidetracked for youth; but a training plan without full-time use of the employee's services and without a job for him at the termination of the development period is unforgivable if he has proved himself.

As for the young man, W. E. Mitchell, vice-president of the Georgia Power Company, whose avowed hobby is that of making human beings out of engineers, recently said: "Broaden your field; lift your eyes; prepare for opportunities; eat up all the responsibilities in sight."

* * * *

Hoover Becomes the Republican Standard Bearer

HERBERT HOOVER was nominated by the Republicans last week at Kansas City as their candidate for President of the United States. That this honor came to Mr. Hoover because he is an engineer is unlikely, he is more than that and his reputation is predicated on his humanitarian as much as on his engineering accomplishments. Nevertheless, it is not too much to claim that it was his training as an engineer which gave him analytical ability and enabled him to handle the weighty matters of feeding Europe and organizing relief expeditions in the Mississippi Valley and elsewhere as engineering problems. His nomination, therefore, is a tribute to engineering training, because any one who has ever heard Mr. Hoover knows that, like Calvin Coolidge, he possesses neither personal magnetism nor the gift of oratory. But —and his management of the Department of Commerce proves it—Mr. Hoover knows how to co-ordinate economics and science with the business of the country as well as with the business of government to the advantage of both.

Moreover, and without any show of partisanship, the business of the country and the aspirations of its citizens will be peculiarly safeguarded by a man with Mr. Hoover's passion for aggressive effort under private initiative. He has on numerous occasions delivered himself on this subject. "Our economic system," he said, "has grown up out of the magnificent effort of individuals. We have grown in efficiency in our individual businesses and in our individual concerns beyond that of any other country in the world." Speaking of government operation, he has declared: "Some faint odors of socialism are still about our country. Some groups would have the federal government undertake the operation of public utilities; some groups would have these operations undertaken by the individual states. The Republican party holds to the protection of public interest by regulation of private enterprise in public utilities—it does not believe in the deadening hand of operation by government bureaucracy."

Such is the man whom the Republican party presents to the people as its standard bearer. To the engineering fraternity, and especially to the electric light and power industry, Herbert Hoover is no stranger. They know

his ability, and he is conversant with their accomplishments. Mutual admiration and respect exist, and did the decision rest with the engineers of the country, Mr. Hoover would be elected by acclamation. No greater tribute could be paid to any man.

* * * *

Beauty Versus Utility

ON THREE widely separated river sites offering enticing possibilities for the generation of hydro-electric power the old question of whether esthetic or economic considerations should come first is once more to the fore. These sites are the Great Falls of the Potomac, the Cumberland Falls in Kentucky and the Royal Gorge of the Arkansas River in Colorado.

In the first case a well-backed company stands ready to develop the site as part of a comprehensive scheme designed to furnish Washington, and perhaps Baltimore, with additional energy; in the second case very powerful utility interests already own the site and await only permission from the Federal Power Commission to put to use the power now "running to waste"; in the third case the leading utility company of Colorado has applications before the state and federal commissions for authority to do likewise. Congress has taken a hand in the Potomac situation and forbidden the national power board to do anything without its approval. Vigorous opposition is also waged by those interested in park development around the capital, as well as by companies antagonistic to the plans of the applicant. Opposition from scenery preservationists has prevented action on the Cumberland project, and the same thing is true so far as to the Royal Gorge, though an early decision from the state body is expected.

It is gratifying that there seems no present disposition on the part of any of the light and power companies concerned to try to ride roughshod over the protesters. On the contrary, a disposition to let the latter's arguments carry their full weight and receive unhurried and meticulous consideration by the authorities in control, and then to abide uncomplainingly by the decision reached, seems manifest. This is as it should be. Any belittlement of views taken by sincere lovers of natural beauty would be unworthy of an industry whose loudly professed desire to serve surely includes among its objects man's higher needs where these are affected as well as his material welfare.

The controversy in each of the three cases has two aspects, just as have had the similar disputes over Niagara Falls and other water-power sites in the past. There is first the argument over whether what the electric companies desire to do would really injure the scenery. There is second the argument already stated over how far an esthetic pleasure which can be enjoyed only by a comparatively few who live near or have the chance to visit the site in question should outweigh a practical benefit to many. Every case that comes up must, of course, be settled on its individual merits. No two are just alike. And when landscape experts, engineers, economists, poets and plain citizens dispute and wrangle, not only with those of opposing views but among their respective selves, any editorial attempt to deliver judgment from the cathedral in a specific case might be as presumptuous as ill advised. Perhaps, none the less, a few general principles may be commended for the consideration of litigants and judges both. We should phrase them somewhat as follows:

First, no natural beauty should ever be harmed or even altered in aspect against general protest in the state immediately concerned. Second, even where the opposition is weak, no hydro-electric exploitation of such sites should take place without convincing proof of its economic necessity and of the public benefit resulting therefrom. Third, when the total horsepower involved is small, and the saving consequently insignificant, the stream had better be left alone to dash among its stones and over its declivities as nature taught it. Are waterfalls, after all, mere waste products of elemental forces? "The beautiful," says Victor Hugo, "is as useful as the useful—in fact, more so."

* * * *

Exports Depend on More than Goods

HOWARD A. LEWIS, whose article on the electrical market in Brazil appears elsewhere in this issue, strikes a keynote as to the development of our export markets when he insists that America must send ideas and sympathy, as well as dollars and enthusiasm, management and engineering skill, to help build and develop the market in which we share. Back of the development of every export market must lie a plan, and the fundamentals of that plan should embody a development of the country involved. This plan should include not only goods and money but ideas and people who will settle there and add their lives and work to the wealth of the nation. Other European nations, and Germany in particular, have followed this plan and have thus entrenched themselves solidly in some countries. The opportunity awaits the American manufacturer in continents like South America and Africa where unexploited markets yet exist.

* * * *

Good Work Accomplished by the Bay State Commission

LAST week the Massachusetts Department of Public Utilities issued a decision of no little importance and value in regard to residence rates on the Boston Edison system. In a comprehensive order the board established the principle of the company's area-energy rate as sound, extended it to cover the entire residential service supplied by this utility (excluding hotels and apartments where bills are not rendered by the company to individual tenants), and determined that at present a zone system of rates presents too many difficulties to be justified in the metropolitan and suburban area served by this leading central-station property of New England. The effect of this finding will undoubtedly be to stabilize the rate situation in the Bay State and so to improve the relations between the operating companies and the commission. These relations have been a bit strained of late in view of the pending issues between the Worcester company, the Cambridge company and the board, and it is very gratifying to record such an approval of a form of rate which President Edgar of the Edison company has well characterized as a solution of the residence-rate problem.

The commission modified the terms of the company's so-called "B" rate to an extent which cuts the company's income a million dollars a year, but this is not expected to interfere with either the dividends or the depreciation charges on this property. The limitations hitherto re-

stricting this rate are withdrawn and the entire residential group of customers will now enjoy the benefits of the inducement-rate principle. The result will, of course, be to encourage the more liberal use of electricity for all home purposes, and it is to be expected that in due course there will be a substantial increase in the total revenue per residential customer along with a much larger use of service per dollar expended. That is, the company should be able to increase its income from this class of business in the not distant future as these customers take advantage of the opportunities to receive more for their money than ever before.

Under these conditions the prospects of future peace in regard to domestic rates on this system appear exceedingly bright, and as the practice and experience of the Boston Edison company are very closely studied by other New England utilities, the lessons of this decision are not likely to be overlooked in other quarters. Among the collateral comments of the commission in this finding it is a pleasure to note that the board sets its face against the general practice of a regulative body's undertaking to establish the entire rate structure of a company except under unusual circumstances, recognizing that this is a matter which falls largely within the field of management. We are not sure that some of our friends among the allocation experts will concede that the difficulties of establishing a zone system are as great as the commission implies, but, be that as it may, it is reasonable to expect that the continuance of uniform residential service rates throughout the many hundreds of square miles served by the Boston company will be very acceptable to the public and not unwelcome to the company. Both the commission and the company are to be congratulated upon this decision.

* * * *

Radio Trade Show Raises a Question

CENTRAL-STATION men who visited the Radio Trade Show in Chicago last week carried away some definite impressions. First was the size of the outpouring—there were 205 exhibitors and 21,000 registrations—dealers, wholesalers and manufacturers and their men. Second were the three current trends in radio so conspicuous in the show—the growing popularity and preeminence of the dynamic type of reproducer, the rapid drift toward the combination of radio and the phonograph in a single cabinet, and the growing importance of furniture to the radio merchant. Each of these trends has a distinct significance to the power-company sales department.

The coming of the dynamic "speaker" is just one more evidence that the art of radio is young and that we may expect fundamental development to continue and bring with it both hazard and opportunity to the retailer. But the alliance between radio and the phonograph housed in expensive furniture that is the finest expression of the cabinetmaker's art is fast changing the whole merchandising aspect of the line. Radio in the past has been an electrical device. It is now taking on the aspect of a musical instrument that is to be sold as such. This transformation will undoubtedly bring a large measure of prosperity to the dealer, but it will call for a higher type of merchandising.

The power company is certainly interested now more than ever in the sale of radio goods. For by the marriage of radio and the phonograph the phonograph also becomes electrical in its amplification as well as its motive power. But fine furniture will be a moving influence in radio sales. Is the power company ready and competent to do a good job in marketing this *de luxe* line? This question deserves the very serious consideration of the industry.

* * * *

Some Impressions of the N.E.M.A. Convention

ANY organization faces a test of its confidence and stability at the end of its initial administration when the man who has had the helm from the beginning steps back and turns over the ship to another steersman. So it was last week with the National Electrical Manufacturers' Association, gathered at Hot Springs, Va., for its second annual convention. It was a year ago that the apparatus, supply and radio manufacturers met together for the first time as one organization. A policies division and an appliance division have since been added, and these five divisions now comprise forty-five sections, each concerned with its own product problems. The association as a whole has naturally been finding itself and groping its way forward toward full industry consciousness and industry purpose. Under the strong leadership of Gerard Swope, it has gained strength and prospered. The year's record is a good one. And it is particularly fortunate that Mr. Swope is to be succeeded in the presidency by another strong man. H. B. Crouse, who heads the incoming administration, is one of the elder statesmen of the electrical manufacturing industry and one from whom much may be expected.

The wisdom of combining the various associations of electrical manufacturers into one industry group is clearly demonstrating itself, particularly in the fields of apparatus and supplies, where much progress has been made both in standards and in policy. It is to be hoped that the small separate groups of appliance manufacturers—the cleaner, clothes washer, ironer and refrigerator associations—may some day join the range, heating, appliance and fan sections in the N.E.M.A. and gain the benefits of unity. Some solution also should be found of the problem presented by the divided leadership in the radio industry, with its rival organizations; but whether or not it is to be found in the N.E.M.A. is, of course, a matter for the radio industry itself to decide.

The record of the year shows that much productive work has been done. Tariff rulings, labor legislation, insurance, codes and ordinances all offer common problems which call for co-operative action on the part of the entire electrical family. In the solution of these problems the association has already won a prominent place in industry councils. Moreover, among the manufacturers friendly personal contacts have worked for forbearance, trust and co-ordination, and there was a spirit of harmony in this meeting that has been sometimes wanting in the past.

President Crouse takes over a going concern that is already contributing substantially to the promotion of industry statistics, standards and improved trade practices and policies. The better feeling that today exists among these many competing manufacturers has grown largely out of the N.E.M.A. and provides a groundwork from which further good fruit should come in the year ahead.

Norway Leads in Hydro-Electric Development

Skjaeggedals-foss, Hardanger

Vemork power plant, Rjukan

THE great water-power resources of Norway were early appreciated by the engineers of that country and utilization has been consistently undertaken.

There are 35 falls of more than 50,000 hp. The consumption of electrical energy exceeds 3,000 kw.-hr. per capita per year.

Vettisfoss, Sogn

Dielectric Data on "Pyrex"

Tests of material over wide range of frequency and temperature establish a standard of comparison for dielectrics exhibiting ionization and hysteresis lag

By C. L. DAWES and P. H. HUMPHRIES
Harvard University, Cambridge, Mass.

IN CONNECTION with dielectric investigations at the Harvard Engineering School it became necessary to know the dielectric properties of slabs of glass over wide ranges of power frequencies and temperature. Preliminary investigations with ordinary plate glass demonstrated that the losses in this type of glass vary so much with temperature that its use for this purpose is undesirable. About this time data published in the ELECTRICAL WORLD[1] showed that the power factor and capacitance of "Pyrex" remained much more nearly constant with change of temperature than with commercial glasses. Hence a piece of "Pyrex" 8 in. (20.3 cm.) square was obtained from the manufacturers. This glass is designated as "Pyrex A" and is a chemical ware glass. It is not the low-power factor, low-dielectric constant "Pyrex" which is supplied for radio and other electrical purposes.

PREPARATION AND METHOD OF TESTING GLASS

Both surfaces of the glass were accurately ground so that they were plane and parallel and the thickness was 0.556 in. (1.411 cm.). Then both surfaces were carefully silvered and a ring of radial thickness $\frac{1}{16}$ in. (1.6 mm.) and having an inside diameter of 4.69 in. (11.9 cm.) was cut through the silver. This gave a test electrode of 17.26 sq.in. (111.3 sq.cm.) area and the guard ring (Fig. 1).

The glass was tested in a high-voltage bridge,[2] the connections of which are shown in Fig. 1; C_1 is a high-voltage air condenser whose capacitance is of the order of 120 micro-mfd.; R_1 is the series resistance in this arm of the bridge; R_3 is a resistance which brings the shielding of the air condenser and vibration galvanometer G to the same potential as the low-voltage plate of the air condenser; C_2 is the test specimen; the primary of the mutual inductance M and R_2 are in series with it to form the other arm of the bridge; R_4 is adjusted to bring the shielding about the low-voltage electrode of C_2 to the same potential as this electrode. Bringing the shieldings to the same potentials as the electrodes which they shield eliminates errors due to shunted capacitances across resistances R_1 and R_2. Without these precautions errors from this cause may be large.

The curves Figs. 2 to 7 were taken at constant potential, 5,000 volts or 9 volts per mil (3.54 volts per millimeter). It was found that up to 5,000 volts and more the voltage had no effect on the power factor and capacitance.

Fig. 2 gives the curves of per cent power-factor as functions of frequency taken at various temperatures from 14 deg. C. to 71 deg. C. These curves are characteristic of good dielectrics. The power factor ordinarily does decrease in this manner with increase of frequency. Also the power factor should increase with temperature.

The watts loss per cubic centimeter as a function of frequency, taken at various temperatures, are given in Fig. 3. These curves are practically straight lines having

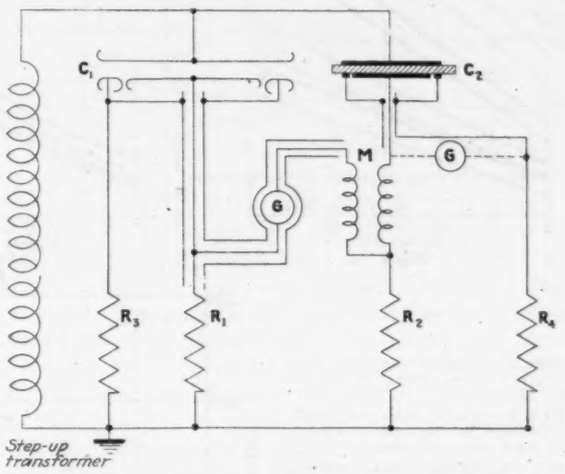


Fig. 1—Connections of high-frequency bridge

positive slopes, but which do not go through the origin. The equation for each temperature is given by

$$P = mf + P_o$$

where P is the watts per cubic centimeter, m is the slope, f is the frequency and P_o is the power at zero frequency; that is, P_o gives the intercept of each curve on the P axis.

If the values of P_o be determined and plotted as functions of temperature the curve shown in Fig. 4 is obtained. This curve is identical in shape with a curve giving the direct-current loss in a dielectric as a function of temperature, when the voltage is fixed. The authors would like to have verified this curve by direct-current measurements. Although we have extremely sensitive apparatus for making such measurements, a sample as small as this one is far beyond even its range of sensitivity. We feel, however, that this relationship is significant, and we hope to verify it further with other experiments which we are making with dielectrics. It also appears that the increase of dielectric loss over zero fre-

[1] *"Power Losses in Commercial Glasses," by W. C. Decker, ELECTRICAL WORLD, Vol. 89, page 601, March 19, 1927.*

[2] *See "Ionization Studies in Paper-Insulated Cables," by C. L. Dawes and P. L. Hoover, Transactions A.I.E.E., Vol. XIV, 1926, page 142.*

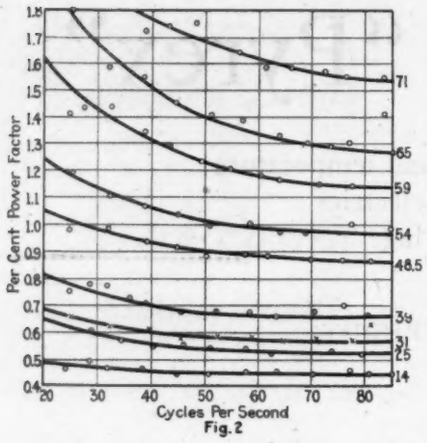
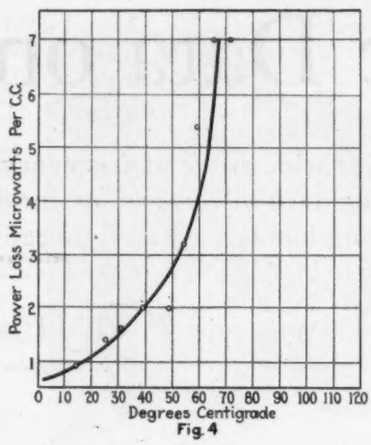


Fig. 2



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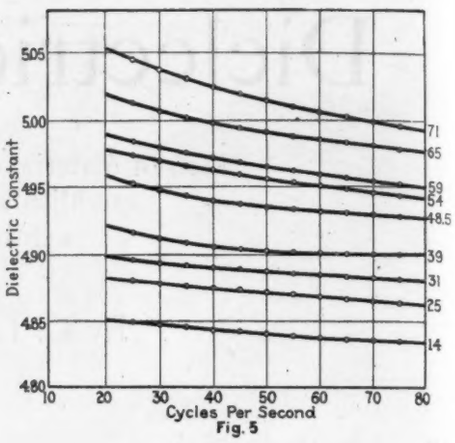

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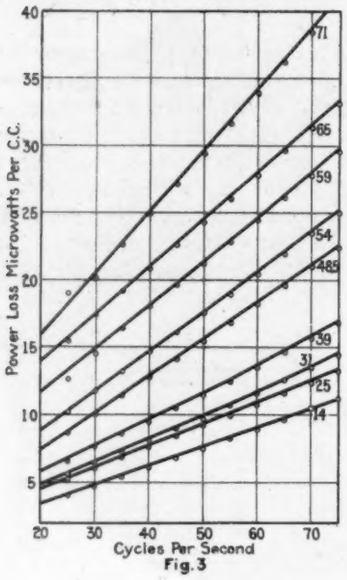
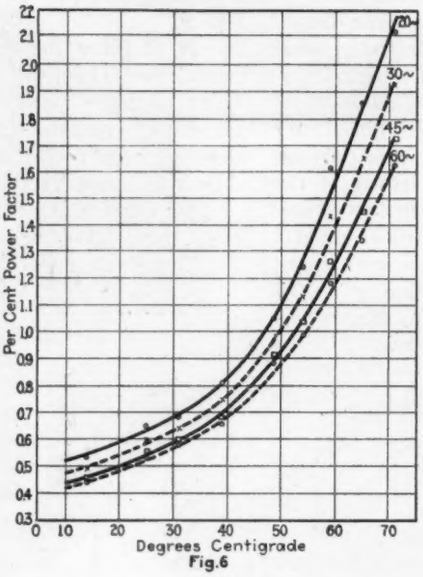


Fig. 3



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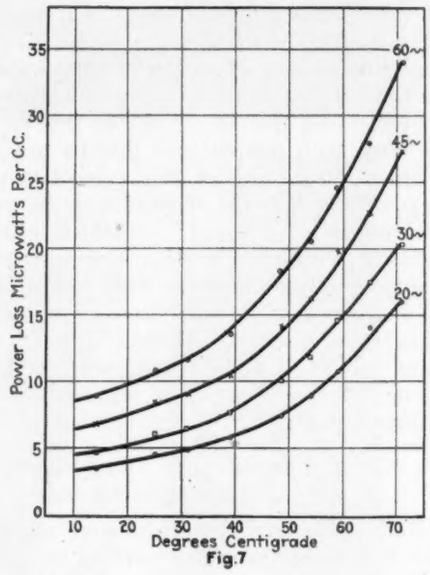


Fig. 7

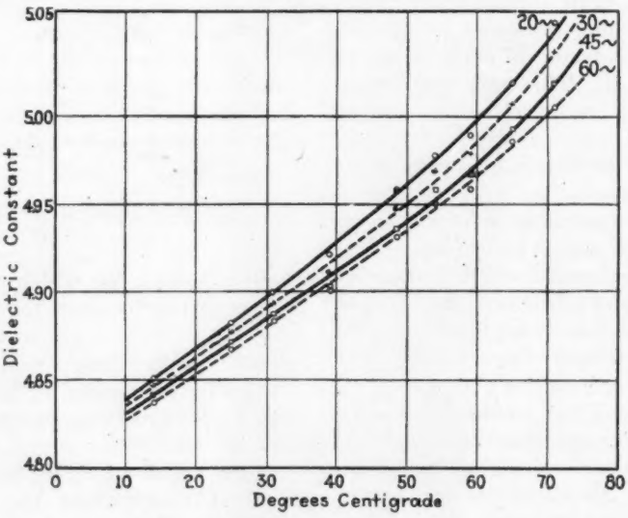


Fig. 8

Fig. 2 — Power - factor - frequency curves from 14 to 71 deg. C.

Fig. 3—Watts loss per cubic centimeter at various frequencies and temperatures.

Fig. 4—Power loss against temperature at zero frequency.

Fig. 5 — Dielectric constant values against frequency for temperatures between 14 and 71 deg. C.

Fig. 6—Variations of power factor with temperature at different frequencies.

Fig. 7—Power loss against temperature at frequencies of 20 to 60 cycles.

Fig. 8—Dielectric constant values against temperature with frequencies of 20 to 60 cycles.

Figs. 2 to 8—Results of tests at constant potential (9 volts per mil)

quency loss is proportional to the frequency. Since "Pyrex" is admittedly an excellent dielectric, we feel that this may be one criterion of an excellent dielectric.

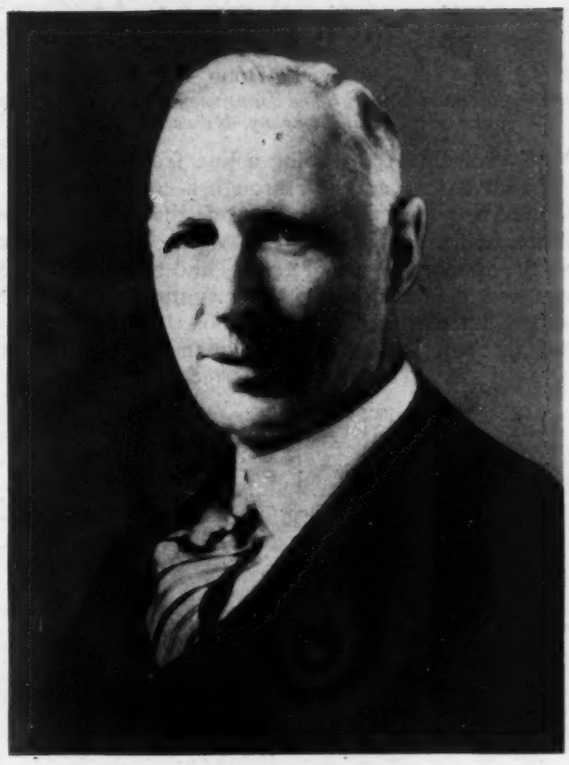
The curves of dielectric constant as a function of frequency, taken at various temperatures, are given in Fig. 5. These curves show that the dielectric constant decreases with increase of frequency and that the dielectric constant increases with temperature. These relationships are common with dielectrics.

Variation of power factor with temperature at frequencies of 20, 30, 45 and 60 cycles per second is shown in Fig. 6; Fig. 7 shows the variation of watts per cubic centimeter with temperature for these same four frequencies; Fig. 8 gives the variation of dielectric constant with temperature also for these same four frequencies.

The foregoing characteristics are important, both from the scientific and practical points of view. They show, over wide ranges of frequency and temperature, the characteristics of a solid dielectric in which there is no ionization and apparently no hysteresis lag. They can very well, therefore, serve as a standard of comparison for the less perfect dielectrics such as cable insulation. They show that with this type of glass the total power loss is not proportional to frequency, but that the increase of loss over that at zero frequency is proportional to frequency.

The Right of Defense

By R. F. PACK
Vice-President and General Manager
Northern States Power Company



R. F. Pack

THE "revelations" and "disclosures" which have so far appeared in print as a result of the Federal Trade Commission's investigation of the electric industry boil down to the simple fact that the industry is using established methods of publicity and education for presenting its case to the public.

The methods used deviate in no essential manner from those repeatedly and successfully employed by other industries, by state and municipal agencies, by political associations and even by those who are objecting violently to such activity by the utilities. A joint committee is formed to insure united action and support. Competent counsel are employed to direct the work and able writers secured to put the facts and arguments into effective form. Naturally funds are required to carry out the program and are supplied equitably by various units of the industry.

What is illegal about any of this? The motive is self-preservation, a more united defense against bitter and mostly unjust attacks on an entire industry. There has been no secrecy concerning any portion of this defense. The industry stands back of and is ready to prove any statement of fact or argument it makes in its behalf. The fact that it has contributed something toward legitimate and valuable research generally, as well as in schools and colleges, and has invited investigation and study of its business by qualified observers, is evidence of the confidence felt in its basic soundness.

Does not the industry have the right to present its side of the case to the public, either through the press or otherwise, particularly when faced with unfair propaganda, charging unreasonably high rates and poor service, where no just ground for such charges exists, and urging municipal or government ownership and operation of the plants in face of facts which conclusively show such operation to be contrary to the best public policy, and when, further, the soundness of well-protected securities is attacked, the fairness and competency of the business organization and management questioned, without supporting evidence? Apparently not, in the opinion of their critics in Washington and elsewhere. From their viewpoint the utilities, together with all incorporated undertakings, should be muzzled and remain mute, while the interests of those who, through the supply of funds, have made much-needed enterprises possible are attacked for selfish reasons by political forces and radical organizations which evidently regard free speech as a special privilege of their own.

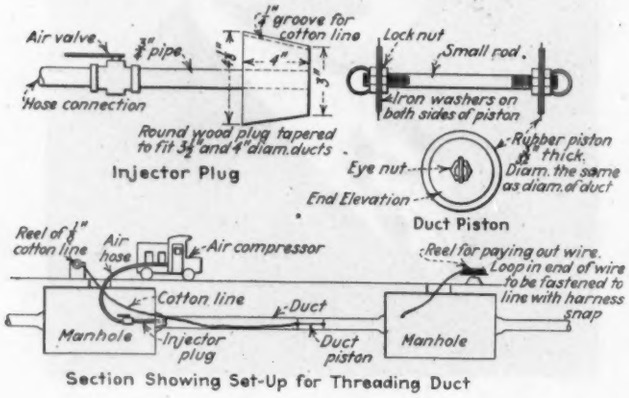
One is almost tempted to believe that the politician and the radical are driven to such a demand as this by lack of campaign material that will stand the test of close scrutiny. Utility commissions, for instance, are now keeping the rate levels of the utilities so low and the standards of their service so high that complaints against unreasonably high rates and inadequate service can now seldom be sustained in fact. This is a matter of record. The records further show that in practically all cases investigated the cost of producing and furnishing the service is much higher under municipal ownership and operation than under private ownership and operation. This is even true when no allowance is made for the fact that municipal plants pay no taxes, while the local, state and federal taxes paid by the privately owned utilities and by the owners of their securities amount in some cases to as much as 15 per cent on their gross earnings. When taxes of all kinds are considered, therefore, the rates should be about 15 per cent lower for municipal than for privately owned utilities. Instead, the average rate is, as a rule, higher for the former and the service poorer. Such facts are not pleasant to those who expect to find votes in bad public utility conditions. It would be better for them if the truth could be suppressed.

The management of the utilities believe that it is their duty to defend, by lawful means, both their business and the investors therein, and are not ashamed of the methods employed to that end. In fact, close scrutiny of both will show that those employed by the utilities will compare very favorably with those employed by their critics. No other industry has accomplished more for the benefit of the public than the public utility industry, nor will it be easy to find one with a cleaner record all around. It is difficult to see how its practices could be bad, for the form of its accounts are prescribed and audited, its rates and standard of service fixed and the security issues effectively regulated by utility commissions.

Threading Conduit

By R. L. Dodd
General Foreman Underground Division, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

THE problem of threading a line from one manhole or pull box to another through a conduit so that a cable may be pulled through it is one that has had many solutions in the past and will have more in the future. From the apocryphal use of ferrets and trained rats with strings tied to their necks to the very matter-of-fact and laborious employment of rod sections the solutions have spread through the range of human ingenuity. One



Duct threading with compressed air and special parts used

method that has had considerable success and which is now in use on the system of the Milwaukee Electric Railway & Light Company uses compressed air.

An air compressor, mounted on a truck, furnishes the power. The air hose is connected to the duct by means of a tapered wooden plug which has a hole bored lengthwise through it and which has a small grooved channel on its surface so that the ⅛-in. cotton lead line may be drawn into the duct. The piston, or carrier, to which the end of the small line is attached consists, as is shown in the drawing, of a pair of rubber disks clamped between smaller iron washers in the ends of a short piece of iron rod, The piston with the line attached is placed in the duct, the injector plug inserted and the air is turned on. Then if all of the attending circumstances are propitious, the piston moves forward at a speed of about 10 ft. per second and drops into the next manhole in a very short time.

When the piston comes through a wire is pulled in and left for the cable crew, which follows the wiring crew a few days later. The process is repeated for each duct to be wired and the compressor moved along the line to every second manhole. Each set-up serves for ducts in two or more directions. Experience of four years with this apparatus indicates that the method is economical and fast for jobs involving two or more ducts and for crooked lines which would otherwise necessitate frequent uncoupling and recoupling of jointed rods.

This method of duct threading, one might say, has the advantages of its disadvantages. By this is meant that if the piston goes through the duct as it should one can be sure that the line is straight and that the duct is clean and in good condition. If there are any large pieces of rubble in the conduit the piston will either drive them before it or will be stopped. If the duct is broken and offset by injury after installation the piston will not pass. From these considerations it is apparent that the passage of the piston through it is almost a guarantee of the good condition of the duct. There are possibilities that the piston may run into a bad condition somewhere in the duct and become jammed. If it cannot be drawn out by the lead line it can usually be freed by rodding.

Four-inch duct runs up to 500 ft. long may be economically threaded and wired by thus substituting compressed air largely for manual labor in tight conduits, such as those of metal or fiber. Conduits of porous material or those having leaky joints permit the escape of the air and limit the distances.

Computing Compensator Settings for Voltage Regulators

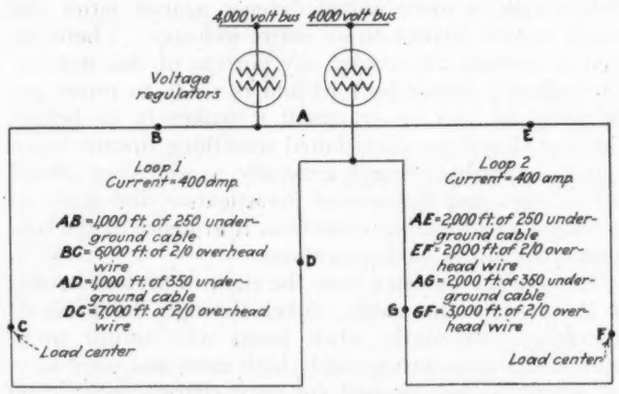
THIRD ARTICLE

By V. W. Palen

DOUBLE LOOP CIRCUITS.—The compensator settings for the single feed and the single loop, discussed in the previous articles, require no unusual tactics. Computations are relatively simple. In the case of the double loop things become a bit more involved. If it is assumed that the circuit shown in the accompanying illustration has been split into two individual loops and that the computations have proceeded in a manner similar to the case of the single loop, which was discussed previously, the results so far would be something like this:

Loop 1	Resistance drop (AC)	= 5.50 volts
	Reactance drop (AC)	= 8.90 volts
	Impedance drop (AC)	= 12.10 volts
Loop 2	Resistance drop (AF)	= 2.70 volts
	Reactance drop (AF)	= 3.94 volts
	Impedance drop (AF)	= 4.82 volts

A slight difficulty arises where two circuits or loops are cross-connected as in this instance, for it is evident


4,000 volt bus
4,000 volt bus
Voltage regulators
A
B
E
Loop 1
Current = 400 amp.
AB = 1,000 ft. of 250 underground cable
BC = 6,000 ft. of 2/0 overhead wire
AD = 1,000 ft. of 350 underground cable
DC = 7,000 ft. of 2/0 overhead wire
C
Load center
D
Loop 2
Current = 400 amp.
AE = 2,000 ft. of 250 underground cable
EF = 2,000 ft. of 2/0 overhead wire
AG = 2,000 ft. of 350 underground cable
GF = 3,000 ft. of 2/0 overhead wire
G
F
Load center

Double loop circuit for illustrating calculations

that each regulator regulates for half of each loop. Where the impedance of one loop is greater than the impedance of the other, for which load center shall the compensator be adjusted? It has been the successful practice of one company to average the values obtained for the two loops and to set the compensator on each regulator for this average value. In this instance the settings would be:

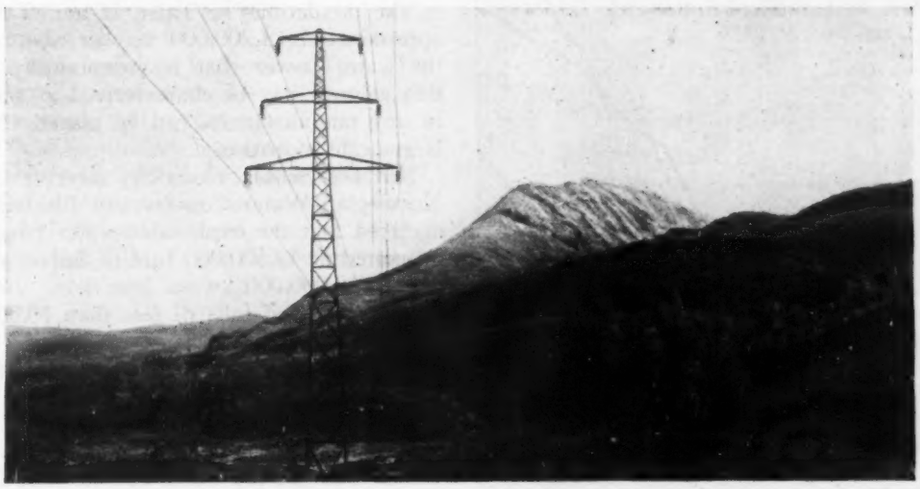
$$IR = \text{(average of } 5.50 \text{ and } 2.70) = 4.10$$
$$IX = \text{(average of } 8.90 \text{ and } 3.94) = 6.42$$
$$IZ = \text{(average of } 12.10 \text{ and } 4.82) = 8.46$$

The computations for the triple loop circuit will appear in the next article of the series.

Hydro Industry in Norway

Pioneer in legal and construction elements. Nearly 2,000,000 hp. developed for industry and public service. Details of development and basic statistics

By GEORGE SMEDAL, JR.



Transmission line from Rjukan to Oslo

THERE is no country in the world where the development of the hydro-electric industry has been so consistent as in the little Scandinavian kingdom of Norway. According to the latest procurable figures, this nation, with a population of only 2,650,000 in 1920, a smaller population than Wisconsin or Georgia, has plants which develop 1,910,000 hp.

The beginning of water power works in Norway, the ancient quern wheels, dates back to the beginning of the nation's history. In 1530 the first water saws were built and, by royal patent, dated Aug. 15, 1616, the privilege of erecting and working such saws was confined to owners of alodial estate. This restriction is generally considered the basis for the present law relating to water courses in Norway. Originally, all water rights belonged to the ground over which the water flowed. This act was particularly definite. If the two banks of the water course happened to be under different ownership, the water rights belonged to both riparian proprietors, each of whom owned one-half, the boundary being drawn along the deepest part of the river.

In modern times most of the best water rights have been separated from the landed property and consolidated in the hands of private persons, combinations of private persons, industrial companies, or to state or local authorities.

The experience and subsequent action by Norway in the control of this great resource have been the basis for similar legislation in many other countries. Especially is this true in regard to foreign ownership of power rights and sites. Until 1888 foreigners could acquire real property in Norway. In that year the act relating to Norwegian citizenship was passed. This provided that foreigners could not purchase real property or hold property in "usufruct" except by special sanction of the crown. The use of waterways in Norway is governed by the act of July 1, 1887, with subsequent supplemental measures, while the acts of Dec. 14, 1917, and May 21, 1921, apply to the regulation of water courses and the purchase of waterfalls.

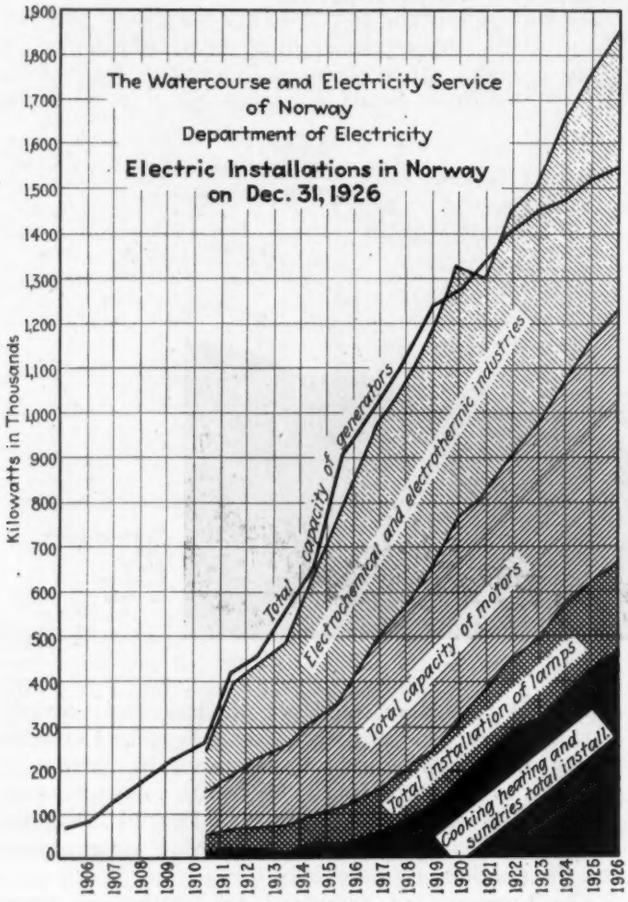
The beginning of industrial exploitation of water power in Norway dates back to 1845, when textile manufacturers undertook its development, and progressed rapidly after the '70s, when the first mechanical pulp mills were established. Figures for 1880 reveal that a total of 30,000 hp. was developed. It was not until 1889, however, that the first hydro-electric works were erected in Hammerfest and Skien. At that period approximately 60,000 hp. was developed. The subsequent growth of the electrification of waterfalls is best shown by the accompanying table.

TABLE I—GROWTH AND USE OF NORWEGIAN WATER POWER

Application	1900 Hp.	1907 Hp.	1913 Hp.	1922 Hp.	1926 Hp.
Wood manufacturers	90,000	117,000	180,000	220,000	230,000
Electricity supply	8,000	31,000	125,000	570,000	690,000
Electrochemical and electro-metallurgical industry	10,000	48,000	390,000	770,000	840,000
Other industries	36,000	42,000	60,000	140,000	150,000
Total	144,000	238,000	755,000	1,700,000	1,910,000

According to 1922 government statistics the exploitable water power in Norway was estimated at 12,300,000 hp. This figure, however, is by no means final. S. Kloumann, director of the Norsk Aluminum Company, Hoyanger, Sogn, Norway, has placed the exploitable

water power at between 16,000,000 and 18,000,000 hp. This is the figure he gave at the World Power Conference in London three years ago. It must also be borne in mind that there is no standard practice in estimating power resources and their distribution. Some nations state their volume of power on the basis of the estimated mean flow in the rivers, regardless of whether or not the possibilities of regulation are existent; in other


The Watercourse and Electricity Service of Norway
Department of Electricity
Electric Installations in Norway on Dec. 31, 1926
Kilowatts in Thousands
Total capacity of generators
Electrochemical and electrothermic industries
Total capacity of motors
Total installation of lamps
Cooking heating and sundries total install.

Electric installations in Norway as of Dec. 31, 1926

cases the volumes of power returned are based upon the calculated regulated flow in the six or nine months when the rivers are at their highest level, and other figures again give the exploitable water power at the nine months' efficient, plus 40 per cent. In respect to Norwegian water power, the returns published here represent power which is disposable over the twelve months of the year in those years when conditions are least favorable and which permits economic exploitation. The 16,000,000 to 18,000,000 hp. as indicated, therefore, represents the least number of horsepower available in Norway for manufacturing industries, handicrafts, public requirements and agriculture which may be obtained from water-power resources within the kingdom.

The Allocation of Distribution

When there is any question of the distribution of Norway's vast resources of water power between public requirements and those of large-scale industries, it is generally agreed that the former should enjoy the preference. How great public requirement will be in the future is a matter of conjecture which cannot now be accurately estimated. It appears, however, that these requirements have been practically met for the present. The great power projects in the north and west are favorably situated for large-scale industries. Considerable volumes of power suitable for industrial purposes exist also in the south, but they are somewhat more costly than that in the west. It may, perhaps, be of interest to set down the more important falls suited to large-scale industrial development. The water courses mentioned, according to their geographical position, are from north to south along the west coast, where harbors are free from ice all year. The accompanying list includes only such water courses as are capable of yielding, when developed, 30,000 hp. or more, and consequently do not include all resources ultimately capable of economic utilization and development.

The tabulations in Table II and Table III comprise approximately 4,200,000 hp., or about 30 per cent of the water power that is economically exploitable, and this volume may be characterized as the minimum that, in any circumstances, can be placed at the disposal of large-scale industries.

Norberg Schulz, electricity director Central Board of Norwegian Water Courses and Electricity Commission, declared that the exploitable water power in Norway is estimated at 12,500,000 turbine horsepower, or approximately 10,000,000 kw. at low flow. In this summation are not included falls of less than 10,000 turbine horsepower or falls that can be harnessed only at an exceptionally high cost. With a population of 2,700,000 Norway has, therefore, about 30,000 kw.-hr. electric energy per inhabitant per year.

The water power is spread throughout practically the whole country; the water courses are, as a rule, easy to regulate, and the extensive mountain wastes offer rich possibilities of water storage. In many Norwegian waterways there exists considerable concentration of great volumes of power, including 35 falls of more than

TABLE II—NORWAY WEST COAST WATER POWERS CAPABLE OF GIVING 30,000 HP. OR MORE

	El. Hp.
Northern Norway	
Elvegaardselven, mainly state property	126,000
Sulitjelma, private	90,000
Glaamfjord, state property, of which 80,000 developed	140,000
Rossen, mainly state property	267,000
Total	523,000
Trondelagen and Southern Norway	
Tunnsjöfoss, private	120,000
Fiskumfoss, private	40,000
Forra in Stjördalen, private	48,000
Aura and Mardöla, now being developed, private	277,000
Aalfoten, owned by several municipalities	53,000
Höyanger, owned by Höyangfaldene, about 27,000 hp. used by aluminium works	80,000
Jöstedalselven, private	60,000
Fortunelven, in three works, private	130,000
Töin, owned by Norsk hydro, under development	100,000
Aurlandfaldene in Sogn, private	200,000
Arnefjord and Tennesvassdragene	60,000
Matre and Haugsdal	90,000
Björva, 24,000 hp. developed, private	40,000
Osa in Hardanger, under development, private	95,000
Sima, Hardanger, private	45,000
Veigo, Hardanger, private	165,000
Kinservik, Hardanger, private	116,000
Tysse, 160,000 hp. developed, private	200,000
Laatefoss, Hardanger	103,000
Mauranger	91,000
Blaafaldene, 95,000 hp. in one station, by the fjord, private	120,000
Vaule	30,000
Saude in Ryfylke, about 45,000, employed mainly by electrometallurgical works at Saude, private	130,000
Förra in Ryfylke, private	87,000
Ulla in Ryfylke, state owned	175,000
Bratlandsdalen, private	80,000
Bleskestadselven, private	75,000
Lyse in Ryfylke, particularly favorable storage possibilities	140,000
Aaen-Sire, owned by the town of Stavanger	50,000
Total	3,000,000

TABLE III—INTERIOR WATER COURSES OF NORWAY AVAILABLE AT A MODERATE COST OF DEVELOPMENT

	El. Hp
Övre Sira and Övre Kvinna, owned partly by the state, partly by municipal authorities, partly private	330,000
Toke, state owned	270,000
Maarelven, partly state owned, partly private	125,000
Hemsila, owned by municipality of Aker	63,000
Holsvassdraget, owned by the city of Oslo	120,000
Aabjöra, private	86,000
Vinsterfaldene, owned by number of municipalities	200,000
Total	1,194,000

50,000 hp. Approximately 60 per cent of all the water power in the country occurs in falls that are 300 m. high or more.

Volume of Power Developed

The accompanying chart shows from the graphic curve that the volume of power developed in Norway, Dec. 31, 1925, was 1,525,147 kw., equivalent to about 15 per cent of the aggregate water power in the country. There thus remains about 10,000,000 turbine horsepower of unharnessed power in Norway, and of this something like 4,800,000 turbine horsepower, taking into consideration only falls exceeding 10,000 turbine horsepower, is lying so near the coast that the cost of transmission to ice-free harbors will not make any material difference in the cost of the power.

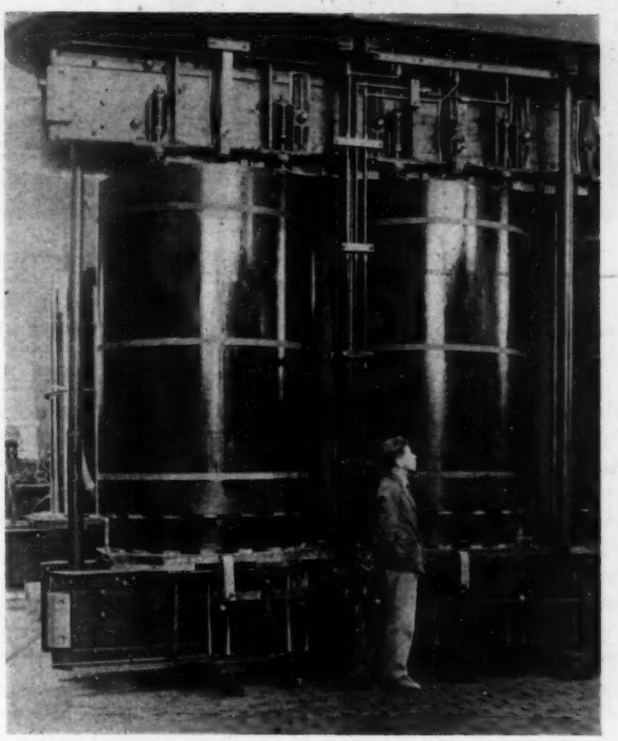
The graphic curve also gives a picture of the rate at which the development of water power proceeded from 1906 to the end of 1925. The curve, in addition, shows that this work made very rapid strides, particularly from 1910, with the result that Norway has become the world's largest producer of electric energy in proportion to the size of the country and population. According to the returns available the production of electric energy in Norway Dec. 31, 1925, was:

	Total Millions, Kw.-Hr.	Per Inhabitant, Kw.-Hr
Public service	1,800	700
Large-scale industry	6,200	2,300
Totals	8,000	3,000

At the end of 1925 production was thus in the neighborhood of 3,000 kw.-hr. per head of the population. Seventy-seven and a half per cent of the total output of energy in the country was used at that time for large-scale industrial purposes. Wood manufacturers are the largest consumers of electricity in Norway, and in the expansion of this industry water power, employed both direct and converted into electric energy, has played an important rôle. Another industry using the abundant supply of cheap electric energy in large quantity is that engaged in the production of nitrate of lime, which is now consuming something like 250,000 kw. of electric energy. For the manufacture of carbide, cyanamide, aluminum, zinc, ferro-alloys and so on, there has so far been developed between 300,000 and 400,000 kw.

The diagram reveals that the electric supply for public service has undergone quite a rapid growth also, and bears comparison to the increase in use of energy for industrial purposes. Whereas the first electricity works constructed in Norway were for private account, and, in a majority of cases, for industrial enterprises, the public services supply has in the last ten or fifteen years become primarily a municipal business, which was at first conducted by the separate local authorities and latterly by large intermunicipal and county-municipal combines.

The extent of the areas of supply and the number of inhabitants are determined by geographical conditions. The inhabited districts of Norway occupy only 25 per cent of the total area of the country, and the population is mostly concentrated in valley districts and along the great extent of deeply indented coast, where mountain and sea form the natural limitation of the areas of supply. The administrative development of electricity

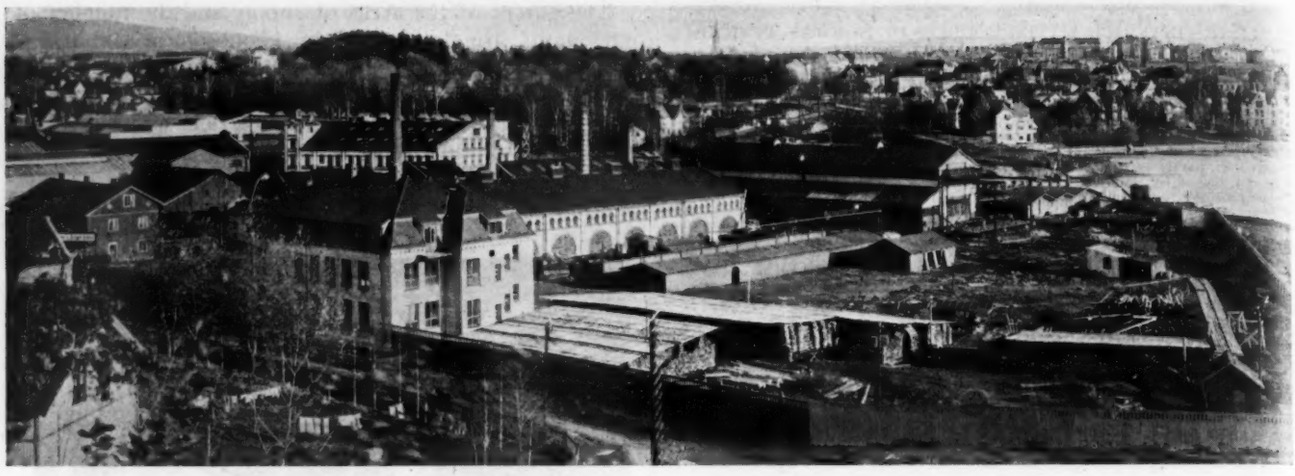


The largest transformer in Scandinavia, 29,000 kva., 143,000/12,000 volts

supply in Norway is best illustrated by the fact that, out of the 335 electricity works in operation in 1924, there were 304 municipal and district works, eighteen intermunicipal, five county-municipal, five large private power companies and three smaller works owned by the state.

The various administrations comprise, in rural districts, supply areas with from a few hundred up to 60,000 and 70,000 inhabitants. Of large supply areas which can conveniently co-operate, there is the so-called Eastland area, representing rather more than 10 per cent of the total area of Norway and containing a population of 1,100,000, of whom 500,000 live in towns and urban districts and 600,000 in purely rural districts. In this supply area, which includes the most closely settled parts of Norway, co-operation has already been established in great measure among the power works. In order to meet the demands of the area for electric energy for years to come the government is now developing the Nore Falls, which is capable of supplying about 150,000 kw. of electric energy.

Of a total population of 2,700,000, 1,900,000, or rather more than 70 per cent, can be supplied with electric energy from power works and distributing plants. Every town in the country is supplied with energy, and of 1,800,000 rural inhabitants approximately 1,080,000, or 60 per cent, can be supplied with energy from the power mains. As the density of population is less in Norway than in most European countries, this development gives



The pioneer electrical manufacturer of Norway, Norsk Elektrisk and Brown Boveri, near Oslo

one some idea of the labor that has been expended in the electrification of rural districts.

The heavy expansion of public service electricity can also be deduced from the amount of capital that has been invested to this end. On Jan. 1, 1916, it was computed that 127,000,000 kroner were locked up in electricity supply for public service, for household purposes and for industrial concerns of such size that they are not supplied with energy from their own plants. On June 30, 1925, the total of 870,000,000 kroner—nearly seven times the estimate of Jan. 1, 1916—was invested in power plants and lines for the delivery of energy at the consumer's house wall. This figure does not include plants that were under construction at that date or house installations, motors and household appliances. If these values are added, a rough estimate of the capital placed in electricity supplies for public service would be something like 1,200,000,000 kroner on Jan. 1, 1927.

The preponderating part of the public service supply is due to the initiative of municipal authorities. The great capital outlays for this purpose in recent years have, therefore, involved municipal and county authorities in a material increase of their burden of debt. According to the returns of the Central Statistical Bureau June 30, 1926, the following ratio existed between the total debt of municipal boards and their liabilities on account of electricity works:

	Total Loan Debt (1,000 Kroner)	Proportion of Debt Devoted to Electricity Works (1,000 Kroner)
Districts and counties.....	733,021	421,820
Municipal boroughs.....	772,204	293,594
	1,505,225	725,414

Of present municipal loans, approximately one-half has been devoted to electricity supply. Interest on and repayment of a substantial part of this debt is covered by the income accruing from the sale of energy. Income from this source amounted to about 83,400,000 kroner in the fiscal year 1924-1925. Total outlay for working expenses, interest, repayments, etc., amounted to 90,200,000 kroner. Expenditures thus exceeded income by about 6,800,000 kroner. This is mainly due to the fact that a large number of power and distributing plants, particularly those for rural supplies, were constructed during the boom period (see chart). Many of these works are at present experiencing difficulty in meeting their heavy annual expenses, part of which have had to be covered out of taxation, and the government, also, has been forced to give assistance in the form of loans, as well as direct grants.

The working results shown by the large joint municipal and county-municipal electricity works that have been completed in the last few years, and the financial burden under which so many local governments are straining, have led to the temporary culmination of the development of large distribution works in rural districts. A contributory cause is the fact that the most densely populated rural districts and those of the best financial standing have been electrified during the last ten or fifteen years. Many of the districts still remaining will unquestionably procure cheaper electricity by constructing small local works than by joining the large intermunicipal and county-municipal combines. For this reason, a number of small plants are now under way in many districts, the intention being to supply energy to hamlets, fishing stations and similar locations.

The writer gratefully acknowledges the whole-hearted co-operation and support of J. Vidnes of the Press Bureau of the Norwegian government, Christian Raestad, consulting engineer, Oslo, and Norberg Schulz, electricity director Central Board of the Norwegian Water Courses and Electricity Commission, in connection with the preparation of this article.

Arc-Proofing Cables

By C. H. Shaw
Engineer Distribution and Installation Department, New York Edison Company

THE definite trend toward the use of higher voltages on underground cable circuits has increased the importance of the arc-proof covering that is placed on the cables in the manholes, especially when new cables are installed in conduit lines that already contain older cable systems.

An extensive series of experiments was undertaken by the New York Edison Company to determine the relative protective values of different combinations of refractory materials through the exposure of specially prepared test samples to controlled electric arcs in which the energy at the arc and the distance of the test material from the arc were maintained uniform, thereby providing test

data that permit direct comparisons. These experiments were recently completed by the New York Edison Company after ten months of investigation. More than 170 samples were tested, each being subjected to from ten to fifteen burns. Two to four samples were made up of each type of material and for the more important cases the samples and tests were duplicated for verification.

The standard form of fireproofing, used by the New York Edison Company for more than fifteen years, consisted of an application of Portland cement (mixture 1:2)

TESTS ON CABLE ARC-PROOFING MATERIALS

Description (all ½-in. thick)	Average Kilowatt-Seconds	Average of 2 Lowest Kilowatt-Seconds
Older Types		
Cement (1:2) on metal lath	1,126	486
Cement (1:2) on ½-in. hemp rope	1,047	656
"Asbestoment" on single ½-in. "Niagrite"	1,060	517
"Asbestoment" on doubled ½-in. "Niagrite"	838	494
New Types		
No. 4 "Asbestoment" on No. 1047 asbestos cloth	1,343	999
No. 4 "Asbestoment" on ½-in. perforated "Niagrite"	1,539	1,019
No. 4 "Asbestoment"—cheesecloth, inner and outer	1,605	1,133

upon metal lath to a total thickness of approximately ⅝ in. over the entire cable sheath. In general, this form of protection has been satisfactory and in every case cables so protected have suffered little or no injury when exposed to manhole fires or short-circuit arcs in adjacent cables. It has always been realized, however, that the preparation and application of the metal lath to the cables was both tedious and objectionable, tedious, because of the necessity of cutting the lath into narrow strips, then rolling it, winding it onto the cable and tying it in place with string from small hand-wound bobbins; objectionable, because of the frequency with which the workmen were scratched or pricked, or, if not injured, delayed in their natural activities by excess carefulness or by the handicap of thick, cumbersome gloves.

An appreciation of the hazards to which the workmen were exposed in handling the metal lath, a recognition of the desirability of discovering cable arc-proofing materials having greater protective values to accompany the increase in voltages and the hope for a less expensive type of covering were the reasons for undertaking this group of tests. The results that have been secured have more than justified the undertaking. The accompanying table gives comparative protective values of some of the older types of fireproofing and for the more important combinations that have been developed as a result of these tests. A great number of experiments were performed that did not give noticeably better results than could be secured from the older forms of fireproofing, but during these tests the advantages of reducing the thickness of the binder that holds the cement to the cable to a minimum became obvious. The advantage, even though slight, that is indicated for the inner and outer cheesecloth samples, was confirmed by tests of other materials applied in the same way.

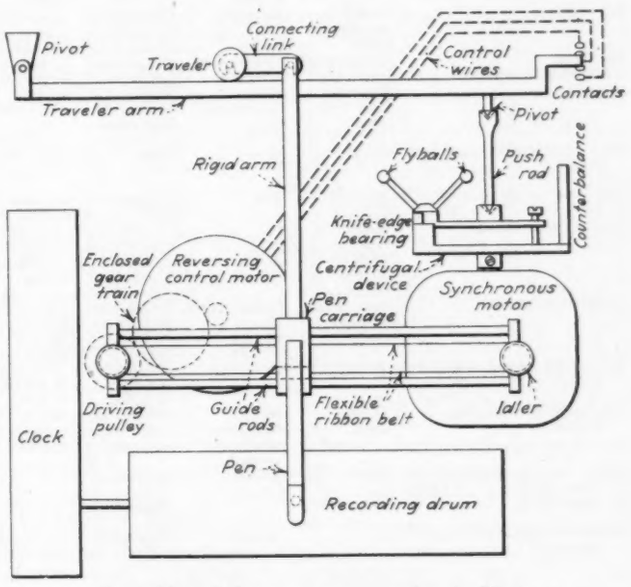
The results obtained with the new "Asbestoment" No. 4 indicate not only a highly desirable increase in the average protection values but a marked improvement in the uniformity of the material as is revealed by a comparison of the averages of the two lowest tests of each group. This new material comes ready mixed as purchased and requires only the addition of a certain amount of water to give a proper working consistency to the cement just prior to its application. The cable is prepared by painting on a coating of hot paraffin over a winding of a layer of cheesecloth that has been purchased in rolls cut 4 in. wide. The No. 4 "Asbestoment" cement is applied over this layer of cheesecloth and is progressively bound in place by an outer layer of cheesecloth of the same dimensions as the inner layer. This outer layer insures a uniformity of the cement that cannot be secured when no outer binder is used and accounts for an appreciable improvement in the arc-resisting qualities of the material. This method of applying the cement to the cable is in accordance with the standard practice of the Philadelphia and Cleveland companies for the application of their Portland cement mixtures.

Sensitivity—A Feature of Centrifugal Frequency Recorder

By F. S. Stickney
Meter Engineer
Westinghouse Electric & Manufacturing Company

A NEW type frequency recorder has been developed recently to meet the need for an extremely sensitive instrument for large alternating-current systems. When a mass is rotated by a synchronous motor the centrifugal force developed is proportional to the square of the frequency supplied to the motor. Application of this fundamental principle produces a recorder of great sensitivity, since large variations in operating force are produced by small variations in system frequency.

The operating principle of the new device may be



Centrifugal frequency recorder indicates instantaneous values

explained by reference to the accompanying illustration. A self-starting synchronous motor running at relatively high speed drives a direct-connected centrifugal device which transfers centrifugal force into an axial thrust upon a vertical push rod. A traveler arm is pivoted at one end, the other end being supported by the push rod. The contacts are used to control a reversible motor, which operates a sliding pen carriage assembly along the traveler arm as the pen is moved.

As long as frequency remains constant the whole sys-

tem of weights remains in equilibrium and the contacts remain open. Any increase in frequency increases the speed of the synchronous motor and throws the system out of equilibrium, thereby moving the pen carriage assembly up scale. As the assembly moves, the traveler is carried along the traveler arm, thereby increasing its moment about the pivot and tending to restore the system to equilibrium. When this is accomplished the upper contacts open and the control motor stops, leaving the recording pen in a new position further up scale, indicating an increase in frequency. When frequency falls the lower contact is closed and the cycle is reversed in a similar manner.

In operation any small change in system frequency immediately produces motion of the recording pen within a small fraction of a second. Being determined by mechanical dimensions and weights only, calibration is not subject to the errors from wave form, voltage or temperature which ordinarily appear in frequency-measuring devices.

Boiler Feed Water Treatment in the Southwest

DATA regarding the conditioning of boiler feed water in ten representative generating stations were presented by Paul F. Hoots at the eighth annual convention of the Southwestern Geographic Division of the National Electric Light Association. The accompanying tabulation covers the major factors of treatment and operation.

Boiler-Water Conditioning Practices Compared

Name of Station	Neches	Dallas	Fort Worth	Market Street	Oklahoma City	New Braunsfeld	Trinidad	Waco	Deepwater	Wichita Falls
Company	Gulf States Utilities	Dallas Power & Light	Fort Worth Power & Light	New Orleans Public Service	Oklahoma Gas & Electric	Coma Power	Texas Power & Light	Texas Power & Light	Houston Lighting & Power	Texas Electric Service
Number boilers with internal water conditioning	2	5	21	6	6	2	4	9	5	4
Heating surface, sq.ft.	15,300	4–17,000 1–18,000	3–20,280 4– 3,861 6– 5,891 8– 5,184	3–18,571 3–19,983	4–10,080 2– 9,040	20,198	21,276	6,000	4–19,884 1–18,348	5,872
Drum pressure, lb. per sq.in. gage	400	350	3–275	3–380 3–390	300	400	425	215	4–365 1–385	250
Average rating, per cent	250	4–200 1–250	3–200	3–225 3–250	4–160 2–300	Min. rating 150	196	160	4–260 1–...	182
Maximum rating, per cent	350	4–300 1–450	3–250	3–300 3–400	4–300 2–500	275	262	225	4–430 1–700	228
Blow-down	35,000 lb. weekly per boiler	Less than 10 in./mo./ boiler	Determined by concentration	None except to clear valves	None except to clear valves	Once a week to clear valves	Approx. 5 in. per wk. boiler	Once a week to clear valves	Approx. 0.25 per cent	Negligible
Make-up	Evaporated	Evaporated	Evaporated	Evaporated	Evaporated	Evaporated	Evaporated	Evaporated	Evaporated	Evaporated
Type of evaporators	Griscom-Russell high heat level	Griscom-Russell submerged type	Griscom-Russell 3-effect high press	Griscom-Russell single effect	Griscom-Russell single effect	Wheeler single effect	Wheeler single effect	Griscom-Russell 2-effect high heat level	Griscom-Russell single effect	Griscom-Russell submerged type
Raw water treat. ahead of evaporat.	None	None	None	Permutit	Permutit	None	Coagulated filtered Permutit	None	None	Permutit(*d*
Make-up water, per cent	Approx. 1.5	2.0	Approx. 2.0	Approx. 5.0 (*a*)	2.0	Oct., 1927 0.88	Approx. 2.25	2.75	1.0	Approx. 4.0
Quality of make-up	Resistance 18,000–30,000 ohms.	.....	.....	Resistance 10,000–30,000 ohms.	5–10 p.p.m. toal solids	No analysis available	Resistance 9000 ohms.	.....	Resistance Approx. 25,000 ohms.	Resistance 7,050 ohms
Condenser leakage	Less than 1.0 per cent	Resist. kept above 40,000 ohms.	Resist. kept above 20,000 ohms.	Resist. kept above 30,000 ohms.	Not measurable	Apparently none	Resist. 30,000 to 45,000 ohms.	Less than 0.05 per cent	Less than 0.1 per cent	Avg.-0.11 per cent Max.-0.15 per cent
Chemicals added to boiler water	NA_3PO_4	NA_2SO_4	H_2SO_4 NA_2CO_3 NA_2SO_4	NA_3PO_4 NA_2CO_3 NA_2SO_4	NA_2SO_4	NA_2HPO_4 $NAOH$ NA_2SO_4	NA_2SO_4 NA_2CO_3	NA_2SO_4 NA_2CO_3(*c*)	NA_2SO_4 NA_2CO_3	NA_2CO_3 NA_3PO_4
Quantity of chemicals added	1–3 lb. daily	90-lb. batches when needed	Accord. to boiler water analysis	Accord. to boiler water analysis	75 lb. daily	Governed by water tests	54 lb. NA_2SO_4 47 lb. NA_2CO_3 /Mo.	.....	50–100 lb. week	0.0059 lb. NA_2CO_3 0.0012 lb. NA_3PO_4(*e*)
Ratio sodium sulphate to total alkalinity (NA_2CO_3 equivalent)	3–1	3–1	Low press. 2–1 High press. 3–1	3–1	3–1	.....	2.5–1 (*b*)	Slightly above 2–1	3–1	No definite ratio (*f*)
Ratio for control of scale deposits	.....	None	Very little scale	10–30 p.p.m. PO_4	None	30 p.p.m. NA_2HPO_4	None	None	None	Total hardness boiler waters below 20 p.p.m.
Total alkalinities maintained	120–170 p.p.m.	200–400 p.p.m.	At least 150 p.p.m.	150–300 p.p.m.	Not artificially increased	.....	170–250 p.p.m.	50 p.p.m. minimum	150–350 p.p.m.	150–300 p.p.m.
Max. sodium chloride concentrations	170 p.p.m.	.....	150 p.p.m.	170 p.p.m.	Not regulated	No control needed (very low)	No attempt to regulate	Not regulated	175 p.p.m.	Not regulated
Dissolved O_2 in feed. C.C./Liter	0.0	0.0	Less than 0.1	0.02–0.10	0.22	0.0	0.0	About 0.0	0.0	0.07
PH. value of feed	.....	No data available	About 7.0	7.5	Has not been determined	Has not been determined	7.0	No data available	8.5 avg. 8.0 min.	Above 7.0
Max. boiler water concentrations	.....	400 p.p.m.	1,650 p.p.m.	1,700 p.p.m.	3,420 p.p.m.	.....	.....	400 p.p.m. total alkalin	1,575 p.p.m.	1,700 p.p.m
Boiler water samples tested	Daily	Daily	Daily	Twice weekly	Once weekly	Daily	Daily	Daily	Daily	Daily

NA_3PO_4—Trisodium phosphate.
NA_2HPO_4—Disodium phosphate.
NA_2CO_3—Sodium carbonate (soda ash).
NA_2SO_4—Sodium sulphate.
H_2SO_4—Sulphuric acid.
$NAOH$—Sodium hydroide (caustic soda).

(*a*) Make-up high due to keeping lines hot n an inoperative low pressure plant, but being gradually reduced.
(*b*) Soon to be increased to 3–1.
(*c*) Sodium sulphate used is slightly acid. Soda ash is used to neutralize this acidity.
(*d*) Permutit softener just being installed and zeolite softened water will constitute evaporated feed.
(*e*) Average quantities added per 1,000 gal. feed water.
(*f*) Sulphates high enough without artificially increasing.

Simplified Distribution Planning

Methods of calculating the economic characteristics of electrical distribution systems, particularly transformer spacing and sizes of line conductor

By W. R. BULLARD
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THE method of utilizing the equations, derived in the preceding articles, for the design of an actual overhead distribution system is given here. It is suggested that the steps noted in the summary be followed. The large number of equations may at first sight make the mathematics appear to be too complicated for practical use. However, since only a few of the equations need be used in any particular study of system economics and since the solution of the more complex equations is given in graphical form, the application of the equations will in most cases be comparatively simple. Furthermore, since the results, once obtained, will be applicable for a number of years in handling the growth of system load, the effort spent in making the calculations will in many cases be amply repaid by the economies that may be effected thereby.

In the sample calculations given the values for the various constants are representative of a section of an actual system now operating in a Southern city.

The section chosen for the example is a residential section, the system having a 2,300/4,000-volt primary and three-wire, single-phase, 220-110-volt secondary. Transformers are set midway between street intersections.

Calculation of Constants.—Following is a summary of the values used for the various constants and the methods of obtaining these values.

C, the cost of copper loss expressed as a fraction of a dollar per kilowatt-hour, equals 0.03215. For the derivation of this value see example given in first article of this series in the section on "Unit Energy Costs."

C_1, the yearly cost of each transformer installation, including cost of losses and fixed charge on investment in dollars per installation per year, independent of size of transformer, is derived by the use of equation 3 (Article II), which gives the algebraic components that enter into this constant—that is:

$$C_1 = W_1 fC + 8{,}760\, W_2 C_4 + C_5$$

where W_1 equals transformer copper loss in kilowatts per transformer installation, independent of transformer size (intersection of axis of losses, Fig. 1 (Article II), ELECTRICAL WORLD, March 24, page 611); W_2 equals transformer core loss in kilowatts per transformer installation independent of transformer size (intersection of axis of losses, Fig. 1 of the second article of this series); C_4 equals cost of core loss in fraction of a dollar; C_5 equals annual fixed charges on cost of each transformer installation. For the derivation of C_4 see the example given in the first article in the section on "Unit Energy Costs."

In the investment from which C_5 is computed there are two items: First, the fixed component of trans-

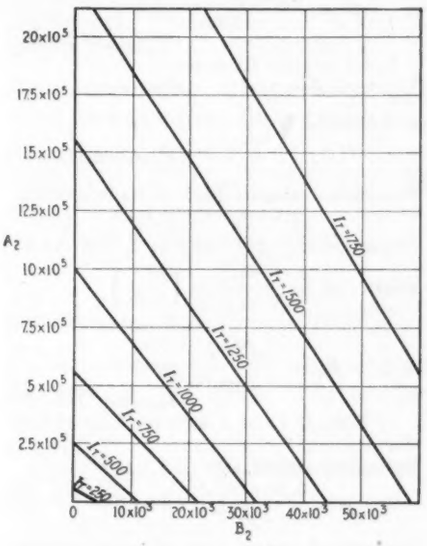


Fig. 1 (left)—Graphical solution of equation 6 (Article III)

The numerical values of A_2 and B_2 for a given system when referred to the ordinates and abscissas represent a point on the surface. By interpolation between the valves of I_T indicated on the curves the proper value of I_T can be determined. This value will represent the most economical ampere load at the transformer.

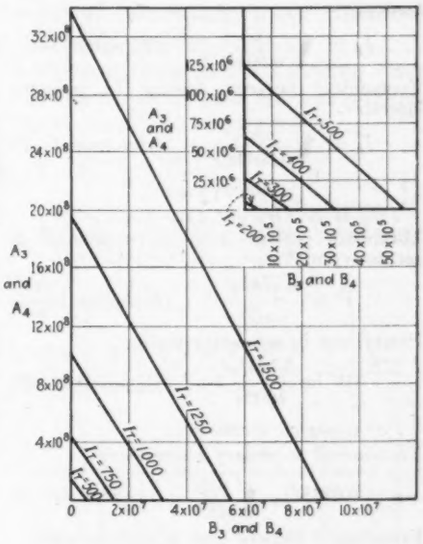


Fig. 2 (right)—Graphical solution of equations 10 and 14 (Article III)

If voltage drop determines the size of conductors the point, the co-ordinates of which are the numerical values of A_3 and B_3, will give the most economical transformer ampere load by interpolation between the straight lines representing different values of I_T. If current-carrying capacity limits size of conductors the point, the co-ordinates of which are the numerical values of A_4 and B_4, will give, by interpolation, the economical transformer ampere load.

**The last of a series of four articles. The first appeared in* ELECTRICAL WORLD, *March 10, 1928; the second and the third in the issues of March 24 and April 21, respectively.*

former purchase price, independent of size of transformer (this value is shown in Fig. 1 of Article II at intersection of the cost axis); second, the cost of installation including auxiliary apparatus, labor, etc.

The numerical value of the investment per transformer installation in the example selected is

Fixed component of transformer cost (from curve)	$56.00
Installation and auxiliary apparatus	97.83
	$153.83
Thirty per cent for overhead expenses	46.17
Total investment per transformer independent of size	$200.00

Annual fixed charge, or C_5, is $0.15 \times \$200 = \$30$.

Inserting the above values in equation 3 (Article II) (values for W_1 and W_2 being taken from Fig. 1 of that article), we have C_1 equal to 35.90.

C_2, the annual fixed charges on investment in line conductors in dollars per year per thousand circ.mils per 100 ft. of single conductor, is derived by using cost of copper per pound delivered at the job, which is $0.245. From this value the cost per 100 ft. per thousand circ.mils is $0.0951. The annual fixed charge, or C_2, is $0.15 \times \$0.0951$, equals $0.01426.

C_3, the annual fixed charges on average total investment costs of primary laterals in dollars per year per 100 ft. of complete circuit, is derived as shown in the following:

Additional cost of longer pole	$7.00
Crossarms, wire, labor, etc	22.30
	$29.30
Overhead construction expenses	7.33
Total	$36.63

List of Equations

Note: Roman numerals indicate article in which formula originally appeared, thus, *I* refers to March 10; *II*, March 24, and *III*, April 21 issues of the ELECTRICAL WORLD

GENERAL

Yearly cost of each transformer installation: $C_t = W_1fC + 8760W_2C_4 + C_3$

(Equation II—3) SEE FIG. 1 ARTICLE II

PRIMARY

Economical current density in primary feeders:

$$I_F = \sqrt{\frac{C_2}{0.0011Cf}} \quad \textit{(Equation I—1)}$$

Economical current density in primary laterals:

$$I_L = \sqrt{\frac{3C_2}{0.0011Cf}} \quad \textit{(Equation I—2)}$$

SECONDARY

Two-Way Straight Line Feeds:

Maximum voltage drop per conductor in secondary mains:

$$V = \frac{0.274I_T^2}{aD} \quad \textit{(Equation II—1)}$$

Power loss in secondary mains:

$$W = \frac{0.183I_T^2}{1000a} \quad \textit{(Equation II—2)}$$

For Complete Economics:

Economical secondary copper size:

$$a = 0.01352I_T\sqrt{\frac{nfC}{n_1C_2}} \quad \textit{(Equation II—4)}$$

Economical ampere load of transformer:

$$I_T = \frac{6.08\sqrt{C_1D}}{(nn_1fCC_2)^{1/4}} \quad \textit{(Equation II—5)}$$

If Voltage Drop Limits the Size of Conductors:

Secondary copper size:

$$a = \frac{0.274I_T^2}{DV} \quad \textit{(Equation II—6)}$$

Economical ampere load of transformer:

$$I_T = 1.221\sqrt[3]{\frac{C_1VD^2}{C_2n_1}} \quad \textit{(Equation II—7)}$$

If Current-Carrying Capacity Limits Size of Conductors (these equations apply to overhead conductors only):

Secondary copper size:

$$a = \frac{I_T^{4/3}b}{1170} \quad \textit{(Equation II—8)}$$

Economical ampere load of transformer:

$$A_1 = I_T^{7/3} + B_1I_T^{5/3}$$

(Equation II—9) SEE FIG. 2, ARTICLE II

where $A_1 = \dfrac{878C_1D}{C_2n_1b}$ *(Equation II—10)*

and $B_1 = \dfrac{125.2nfC}{C_2n_1b^2}$ *(Equation II—11)*

FOUR-WAY NETWORK FEEDS

Maximum voltage drop per conductor in secondary mains:

$$V = \frac{0.0685I_T^2}{aD} \quad \textit{(Equation III—2)}$$

Power loss in secondary mains:

$$W = \frac{0.04575I_T^2}{1000a} \quad \textit{(Equation III—1)}$$

For Complete Economics:

Economical secondary copper size:

$$a = 0.00676I_T\sqrt{\frac{nfC}{n_1C_2}} \quad \textit{(Equation III—5)}$$

Economical ampere load of transformer:

$$A_2 = I_T^2 - B_2I_T^{1/2}$$

(Equation III—6) SEE FIG. 1, ARTICLE IV

where $A_2 = \dfrac{74C_1D}{\sqrt{nn_1fCC_2}}$ *(Equation III—7)*

and $B_2 = \dfrac{26.15C_3\sqrt{LD}}{\sqrt{nn_1fCC_2}}$ *(Equation III—8)*

If Voltage Drop Limits the Size of Conductors:

Secondary copper size:

$$a = \frac{0.0685I_T^2}{DV} \quad \textit{(Equation III—9)}$$

Economical ampere load of transformer:

$$A_3 = I_T^3 - B_3I_T^{3/2}$$

(Equation III—10) SEE FIG. 2, ARTICLE IV

where $A_3 = \dfrac{7.3C_1VD^3}{n_1C_2}$ *(Equation III—11)*

and $B_3 = \dfrac{2.58C_3VL^{1/2}D^{3/2}}{n_1C_2}$ *(Equation III—12)*

If Current-Carrying Capacity Limits the Size of Conductors. (These equations hold only for underground conductors):

Secondary copper size:

$$a = \frac{I_T^2b}{160{,}000} \quad \textit{(Equation III—13)}$$

Economical ampere load of transformer:

$$A_4 = I_T^3 - B_4I_T^{1/2}$$

(Equation III—14) SEE FIG. 2, ARTICLE IV

where $A_4 = \dfrac{80.000C_1D}{C_2n_1b}$ *(Equation III—15)*

and $B_4 = \dfrac{28.280C_3\sqrt{LD}}{C_2n_1b}$ *(Equation III—16)*

TWO-WAY NETWORK FEEDS

Maximum voltage drop per conductor in secondary mains:

$$V = \frac{0.391L^{2/3}I_T^{4/3}}{aD^{1/3}} \quad \textit{(Equation III—4)}$$

Power loss in secondary mains:

$$W = \frac{0.2905D^{2/3}L^{2/3}I_T^{4/3}}{1000a} \quad \textit{(Equation III—3)}$$

For Complete Economics:

Economical secondary copper size:

$$a = 0.01703\sqrt{\frac{nfC}{n_1C_2}}\,D^{1/3}L^{1/3}I_T^{2/3} \quad \textit{(Equation III—17)}$$

Economical ampere load of transformer:

$$A_5 = I_T^{8/3} - B_5I_T^{1/3}$$

(Equation III—18) SEE FIG. 3, ARTICLE IV

where $A_5 = \dfrac{44C_1}{\sqrt{nn_1fCC_2}}\left(\dfrac{D^{2/3}}{L^{1/3}}\right)$ *(Equation III—19)*

and $B_5 = \dfrac{15.58C_3L^{1/6}D^{1/6}}{\sqrt{nn_1fCC_2}}$ *(Equation III—20)*

If Voltage Drop Limits the Size of Conductors:

Secondary copper size:

$$a = \frac{0.391L^{2/3}I_T^{4/3}}{VD^{1/3}} \quad \textit{(Equation III—21)}$$

Economical ampere load of transformer:

$$A_6 = I_T^{1/3} - B_6I_T^{1/3}$$

(Equation III—22) SEE FIG. 4, ARTICLE IV

where $A_6 = \dfrac{1.92VC_1D^{4/3}}{n_1C_2L^{2/3}}$ *(Equation III—23)*

and $B_6 = \dfrac{0.678C_3VD^{5/6}}{n_1C_2L^{1/6}}$ *(Equation III—24)*

If Current-Carrying Capacity Limits the Size of Conductors. (These equations apply only to overhead conductors):

Secondary copper size:

$$a = \frac{I_T^{4/3}b}{1170} \quad \textit{(Equation III—25)}$$

Economical ampere load of transformer:

$$A_7 = I_T^{7/3} - B_7I_T^{1/3}$$

(Equation III—26) SEE FIG. 5, ARTICLE IV

where $A_7 = \dfrac{877.5C_1D}{C_2n_1b}$ *(Equation III—27)*

and $B_7 = \dfrac{310C_3}{C_2n_1b}\sqrt{LD}$ *(Equation III—28)*

The annual fixed charge, or C_3, is 0.15 × $36.63, equals $5.50.

The system in question has a three-wire, single-phase, 220-110-volt secondary; therefore, n and n_1 are 2 and 3 respectively.

D, the load density at yearly peak load in amperes per 100 ft. per current-carrying conductor of secondary mains, was calculated from the substation load curves of the section considered with an allowance for diversity and an allowance for load growth for seven years in the future. Its value, 8 amp. per 100 ft., is the total yearly peak load of the section, including the above allowances, divided by the total length of streets in 100-ft. units.

L, the length of a block in units of 100 ft., by scaling off the streets on a map of the section was found to be 3.5.

Having found all the values of the constants, we can now proceed to use the equations involved in calculating the economical transformer spacing and copper size.

Calculations for Complete Economics.—Since the secondary mains have a network arrangement and transformers are located midway between street intersections, equation 18 (Article III), applies, or

$$A_5 = I_T^{5/3} - B_5 I_T^{1/2}$$

The most economical transformer ampere load, I_T, is found from Fig. 3, providing the values of A_5 and B_5 are known. The values for A_5 and B_5 are given by equations 19 and 20 of Article III, or

$$A_5 = \frac{44\,C_1}{\sqrt{CC_2n_1nf}}\left(\frac{D^{2/3}}{L^{1/3}}\right) = \frac{44 \times 35.9 \times (8)^{2/3}}{\sqrt{0.03215 \times 0.01426 \times 3 \times 2 \times 1{,}600}\,(3.5)^{1/3}} = 1{,}972$$

$$B_5 = \frac{15.58\,L^{1/6}D^{1/6}C_3}{\sqrt{CC_2n_1nf}} = \frac{15.58 \times (3.5)^{1/6}(8)^{1/6} \times 5.5}{\sqrt{0.03215 \times 0.01426 \times 3 \times 2 \times 1{,}600}} = 71.2$$

The value of I_T, which is found from Fig. 3 by interpolation, is 115 amp. The economical cross-sectional area of secondary mains required to carry this load is given by equation 17 (Article III), or

$$a = 0.01703\sqrt{\frac{nfC}{C_2n_1}} \times I_T^{2/3} \times L^{1/3} \times D^{1/3}$$

$$= 0.01703\sqrt{\frac{2 \times 1{,}600 \times 0.03215}{0.01426 \times 3}} \times (115)^{2/3} \times (3.5)^{1/3} \times (8)^{1/3} = 59.9 \text{ M.C.M.}$$

By the use of equation 4 (Article III) the maximum voltage drop in secondary mains is found to be:

$$V = \frac{0.391\,L^{2/3}I_T^{4/3}}{aD^{1/3}} = \frac{0.391(3.5)^{2/3}(115)^{4/3}}{59.9 \times (8)^{1/3}} = 4.23 \text{ volts}$$

The assumed maximum allowable voltage drop per conductor in the particular system in question is 3 volts.

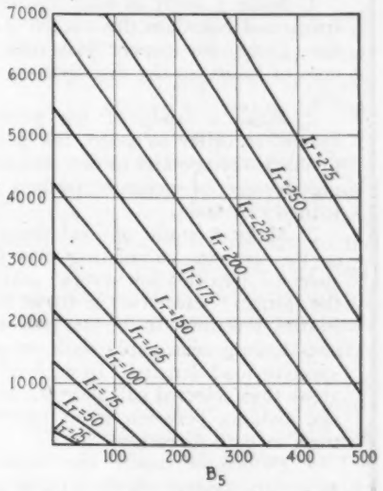


Fig. 3—Graphical solution of equation 18 (Article III)

The point the co-ordinates of which are the numerical values of A_5 and B_5 gives, by interpolation, the most economical transformer ampere load.

The above value is higher than this; therefore it is necessary to make a new set of calculations using equations that are limited by allowable voltage drop.

Calculations With Voltage Drop as the Limiting Factor.—Proceeding as in the previous case but using equation 22 (Article III), we have

$$A_6 = I_T^{7/3} - B_6 I_T^{1/2}$$

where

$$A_6 = \frac{1.92\,VC_1D^{4/3}}{n_1C_2L^{2/3}} = \frac{1.92 \times 3 \times 35.9 \times (8)^{4/3}}{3 \times 0.01426 \times (3.5)^{2/3}} = 33{,}600$$

$$B_6 = \frac{0.678\,VC_3D^{5/6}}{n_1C_2L^{1/6}} = \frac{0.678 \times 3 \times 5.5 \times (8)^{5/6}}{3 \times 0.01426 \times (3.5)^{1/6}} = 1{,}202$$

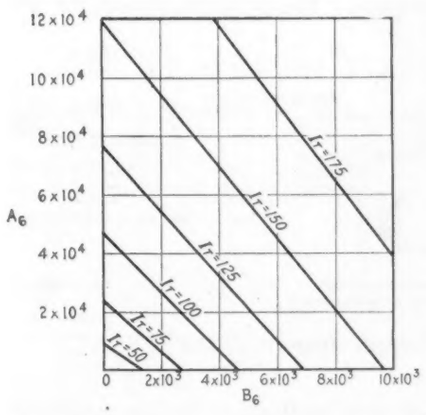
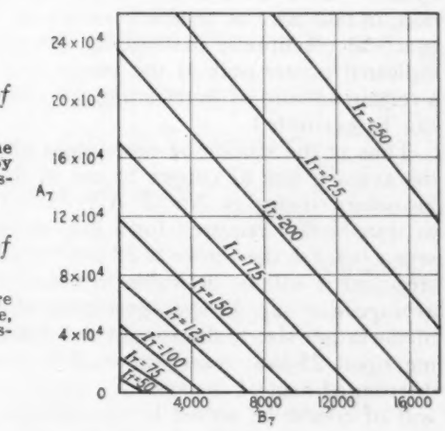


Fig. 4 (left)—Graphical solution of equation 22 (Article III)

The point the co-ordinates of which are the numerical values of A_6 and B_6 will give, by interpolation, the most economical transformer ampere load.

Fig. 5 (right)—Graphical solution of equation 26 (Article III)

The point the co-ordinates of which are the numerical values of A_7 and B_7 will give, by interpolation, the most economical transformer ampere load.



The value of I_T, which is found from Fig. 4 by interpolation, is 98 amp. The cross-sectional area required to carry this load is given by equation 21 (Article III), or

$$a = \frac{0.391\,L^{2/3}I_T^{4/3}}{VD^{1/3}} = \frac{0.391 \times (3.5)^{2/3}(98)^{4/3}}{3 \times (8)^{1/3}} = 68.3 \text{ M.C.M.}$$

The nearest practical wire size corresponding to this

Steps in Study of Distribution Economics

THE various steps to be taken in applying the methods described to a study of the economics of any given distribution system are as follows:

1. Make a study of load characteristics and calculate the annual duration factor for copper loss and the cost of losses in the distribution system.

2. Make a study of the primary system in order to select the proper primary voltage and to determine the proper size of primary feeders and primary laterals.

3. Make a study of load densities of the system, calculating the prospective densities for several years in the future. Select two or three areas in the territory to be served, each area having reasonably uniform prospective load density. In each of the areas thus selected calculate the average distance between street intersections in both directions.

4. Determine upon the type of secondary system which is to be used —that is, whether three-phase, four-wire or single-phase, three-wire, etc.

5. Determine which set of formulas for economics of copper size and transformer spacing applies to each section of territory that has been selected as mentioned above—that is, whether it is to be network or straight line feed, two way or four way.

6. Calculate the economical transformer load current and secondary copper size for each section, assuming these values to be independent of voltage drop or current capacity of secondary mains.

7. From the values thus obtained determine whether the allowable voltage drop or current capacity would be exceeded.

8. If the current capacity or allowable voltage drop would be exceeded by the values obtained from the over-all economics, recalculate the values by the proper equations, depending upon whether voltage drop or current capacity is the limiting factor.

9. In a solidly interconnected alternating-current network system the copper size and transformer spacing may be limited by the ability to burn off low-voltage short circuits. The values obtained by the above procedure should be checked as to their relation to this feature and revised if necessary.

10. The values finally obtained for transformer load and copper size are average values to be used to serve the general distributed load of the system. These sizes should be adhered to in the majority of cases and the growth of load should be taken care of by setting additional transformers rather than increasing the transformer sizes, although it may be necessary to use somewhat smaller transformer sizes at the start in order to hold the voltage drop within the proper limits. If the load densities have been calculated for several years in the future, the values obtained by the described methods can usually be adhered to for a number of years without fear of varying materially from the proper economics. After a number of years, however, a new study should be made and new values adopted, for extensions and replacements of the system.

cross-sectional area is No. 2 A.W.G. The current in secondary mains nearest to the transformer is one-half of I_T, or 49 amp. This is considerably less than the current-carrying capacity of No. 2 wire. Therefore this size is satisfactory as far as temperature limitations are concerned, and no further detailed calculations are necessary.

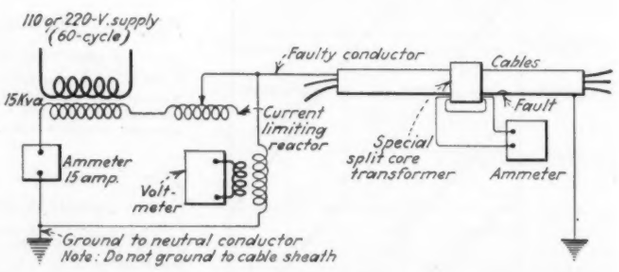
The transformer size corresponding to the above current is 220×98 equals 21.55 kva. The nearest practical size is 25 kva., which with an average load current of 98 amp. as indicated above, will leave a margin of safety of 14 per cent of the normal capacity of the transformer. This is sufficient, in the case under consideration, to take care of ordinary variations of loading under practical conditions, particularly since the load current indicated occurs only at the yearly load peak, and since a certain amount of overloading for short periods of time can be permitted.

Thus in the section of the system under consideration the average size of copper to use in the construction of secondary mains is No. 2 A.W.G. The average size of transformer required for a load density estimated for seven years in the future is 25 kva. For the present construction it will be desirable to use a somewhat smaller average size, say, 15 kva., gradually adding transformers of the larger size to the system and eventually standardizing upon 25-kva. transformers for serving the general distributed load of the system. Large concentrated loads will of course be served by transformers of sizes corresponding to the individual loads, plus small allowances for additional capacity for serving portions of the general system load.

In laying out and operating the system the transformer spacing will be determined by the percentage loading selected for the transformers. That is, in the case of the 25-kva. transformers the spacing must be such that the average transformer peak load will be 98 amp. Individual variations from this value will probably bring about the overloading of some transformers and the loading of others below the desired amount. However, the net result will be an over-all cost of distribution at or near the theoretical minimum value.

Locating Underground Network Cable Faults

THE more or less delicate methods for locating faults which are used to good effect on high-voltage cables were not always so successful when they were applied to the low-voltage network cables of the Dallas (Tex.) Power & Light Company. The principal reason for the poor performance of these methods is the low conductor resistance as compared to the high fault resistance in the usual case of a fault, especially if it is under water. Recourse has been had, and successfully, to probably the simplest and oldest principle of all, but with a different type of testing equipment from that ordinarily used for such work.



Schematic diagram of test

As shown in the accompanying illustrations the testing equipment consists of a 15-kw. transformer, a reactor

and the necessary control and measuring equipment, which is mounted on a truck. One lead of the transformer is grounded, the other, at 4,000 volts, is connected to the faulted cable conductor and a current of 20 amp. applied at such intervals as desired for testing. The current is limited by the top connection to the reactor, a special form furnished by the States company. The exploring equipment consists of a special core transformer

Network cable fault locating apparatus

and an ammeter. On account of the relatively large diameter of the cable to be encircled by the transformer in comparison with the magnetic field surrounding the conductor, it is necessary for the transformer to be designed for very high sensitivity. To meet this requirement the Western-Electro Mechanical Company furnished a transformer with an extraordinarily large core and which weighs about 25 lb. The ammeter, which is really a very sensitive alternating-current millivoltmeter, is also of special design and is of the thermally operated type. The equipment has been in use for several years and has repeatedly demonstrated its convenience, speed and accuracy in locating various kinds of faults where other methods failed.

188 Kw.-Hr. per Year per Cow

FIGURES compiled by the agricultural power committee of the Pacific Coast Electrical Association to show the value of one cow to the central station when the dairy is completely electrified give the following interesting results:

Operation	Average Annual Consumption (Kw.-Hr.)
Milking	25
Pumping drinking water	13
Lighting barns, yards, etc	5
Cream separation	1
Sterilizing utensils	100
Milk cooling	18
Feed chopping	26
Total	188

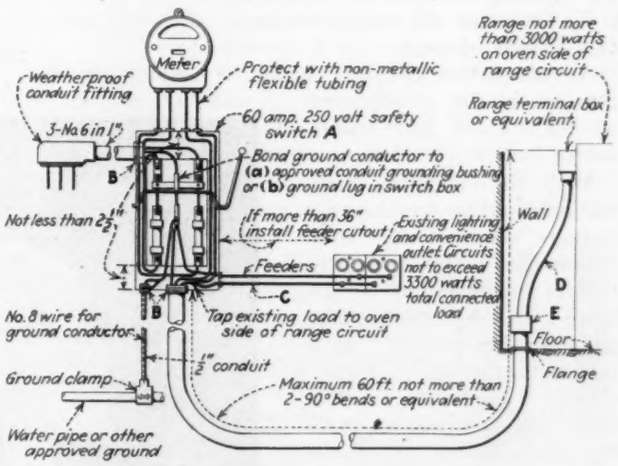
If alfalfa land is irrigated by electric pumping it was found that an additional 240 kw.-hr. per year per cow is required, assuming that the average pumping head is 40 ft. and that one acre of alfalfa is required to maintain one cow.

The report shows that all of the operations listed can be carried out to the economic advantage of the dairyman.

New Range Wiring Standards Reduce Cost

ESTABLISHMENT of minimum range wiring specifications for installation of electric ranges in homes already wired, which will reduce wiring costs in many localities approximately 25 per cent, was one of the outstanding accomplishments of the Commercial Section of the Pacific Coast Electrical Association during the past year. With the new standards approved for a year's field trial by the California Association of Electrical Inspectors, one of the biggest obstacles in the past to the sale of electric ranges in California has been removed. If adopted by individual city inspection departments throughout the state a uniform minimum wiring standard will replace local rules of varying requirements heretofore in force.

Important features of the new standards are: Providing the lighting and convenience outlet load does not exceed 3,300 watts and the branch fuse cabinet is not more than 36 in. from the range service switch, a separate service and switch for the lighting is not required; providing there are not more than two 90-deg. bends or the equivalent in the conduit run from the service switch to the range, three No. 6 wires may be run in 1-in. conduit instead of 1¼ in., as previously required; No. 8 wire may be used for grounding the neutral of the range service instead of No. 6, as previously required, in case the range service consisted of three No. 6 wires; flexible conduit is now permitted in the run from the main service switch to the range; in practically all cases a switch at the range end of the conduit run is no longer required. Details of the new specifications are given in the accompanying schematic diagram.


Meter
Weatherproof conduit fitting
3-No.6 in 1"
Protect with non-metallic flexible tubing
60 amp. 250 volt safety switch A
Range not more than 3000 watts on oven side of range circuit
Range terminal box or equivalent
Bond ground conductor to (a) approved conduit grounding bushing or (b) ground lug in switch box
B
Not less than 2½"
If more than 36" install feeder cutout
Existing lighting and convenience outlet circuits not to exceed 3300 watts total connected load
Wall
Feeders
C
D
E
No.8 wire for ground conductor
Tap existing load to oven side of range circuit
Floor
Flange
1" conduit
Ground clamp
Maximum 60 ft. not more than 2-90° bends or equivalent
Water pipe or other approved ground

Schematic range wiring for demands not exceeding 50 amp.

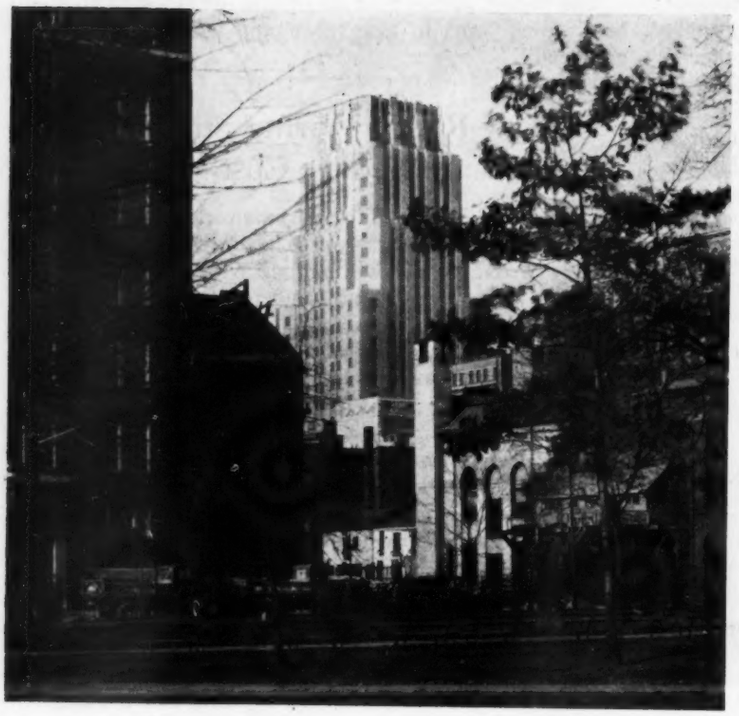
A—Service switch may be installed: (*a*) Inside or outside family dwellings. (*b*) Inside each apartment or on same floor level outside each apartment, in two-family and multi-family dwellings.

B—Double locknuts and approved bushings on all conduits entering service switch box.

C—For surface work, if not over 12 in., protect with flexible tubing. If more than 12 in., install in metal conduit with approved fitting, or in metal gutter.

D—One-inch flexible metallic conduit not more than 36 in. Long enough to permit movement of range not less than 6 in. from wall.

E—Approved outlet box and cover or direct connection to end of range conduit run. Avoid unnecessary joints in range circuit conductors.



Motion-Color

Philadelphia Electric Company provides exterior illumination of its new building to enhance civic attractiveness and demonstrate lighting possibilities

By ARTHUR A. BRAINERD
Assistant Illuminating Engineer
Philadelphia Electric Company

IN FLOODLIGHTING its new 26-story building, the Philadelphia Electric Company decided that it should, if possible, be superior to the lighting of any similar building in the world. Leading floodlighting authorities were consulted and the following guides to designing the system were adopted:

1. The system must be flexible enough so that we could be assured of producing an effect that would be different from and more attractive than any installation installed in the vicinity within at least five years.

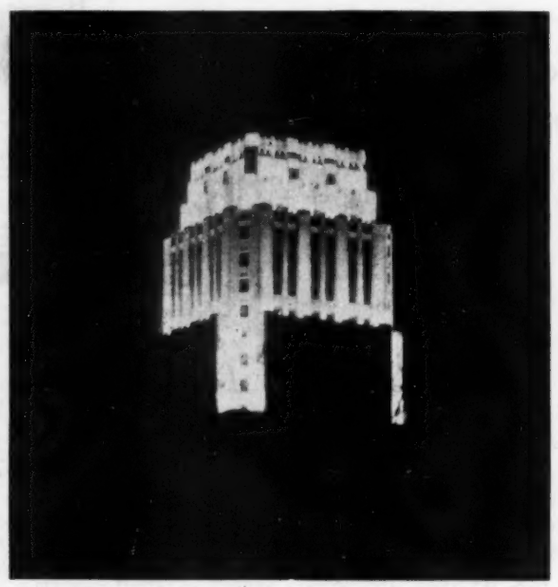
2. As far as possible the units should be located on the building and concealed from sight.

3. To secure the maximum value both color and motion should be used.

4. Adequate provision must be made for rapid changes in the arrangement of both color and motion media.

Very little definite information could be found on the wattage required for color illumination to produce satisfactory visibility at a distance of several miles, or on the desirable dimming speed for motion effects. Consequently experiments were conducted in which a 70x15-ft. panel having about the same reflection factor as the new building was illuminated and observations made at distances up to 1.75 miles.

These tests warranted the installation of two separate floodlighting systems—one to be normally equipped with clear lamps and connected to a theatrical dimmer and the other normally equipped with color. It was found that the clear lighting should have approximately 50 per cent of the wattage of the color lighting. Furthermore, the projectors equipped with clear lamps should be slightly nearer the building and slightly lower down than the color equipment. With the brick under consideration 8 to 9 watts per square foot produced excellent results.

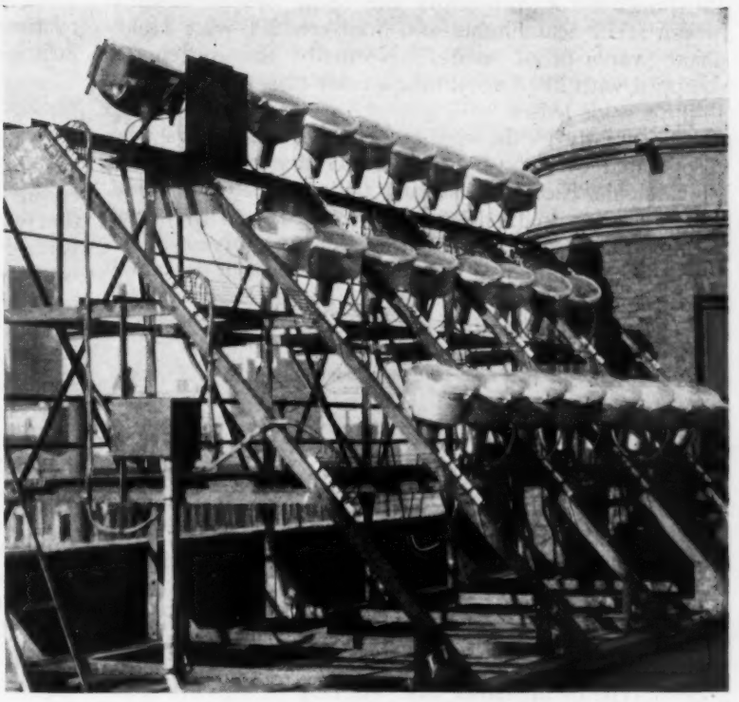


Night view from Washington Square with color and motion left to the imagination

Referring to the illustrations it may be observed that the building is a towered structure, with a small rectangular balcony at each corner on the fifteenth floor and balconies on three sides on the eighteenth and twenty-second floors. There is also a narrow balcony on the fourth side of the twenty-second floor. Below this level the wall of the building is unbroken. The majority of people will view the building from a distance of half a mile or more.

On each fifteenth floor corner are placed 30 500-watt projectors, ten connected to a dimmer circuit and the rest directly across the line. These units are placed on steel framework as far from the building as possible. The space covered is from the fifteenth to the twenty-second floor. On the eighteenth floor, on the north, east and south sides, the projectors are grouped in front of the pilasters, which are of two widths ($2\frac{1}{2}$ ft. and 7 ft.) and extend to the twenty-second floor. The groups consist of three projectors and nine projectors respectively for the narrow and wide pilasters. One-third of these projectors were on dimmers. On the twenty-second floor the arrangement was more irregular, but the same general rule was followed. Except where wide pillars jut out into the balcony all projectors are mounted close to the parapet

Floodlighting



A bank of 29 projectors

and as high as possible. The total number of projectors on this floor is 162, 62 of which are dimmers.

On the twenty-third story level there is a wide ledge which cannot be reached satisfactorily by projectors. On each of these ledges was mounted a 200-watt prismatic vapor-proof unit turned base out and equipped with a natural finish colored lamp. The units stand out as jewels and entirely relieve the harsh shadow which otherwise would exist.

The west side of the building from the eighteenth to the twenty-second floors is illuminated by two banks of projectors on the roof of the adjacent building, consisting of 48 1,000-watt projectors, sixteen of which are on dimmers. At this level there are also two 18-in. incandescent searchlights to take care of two inaccessible spaces above the twenty-second floor.

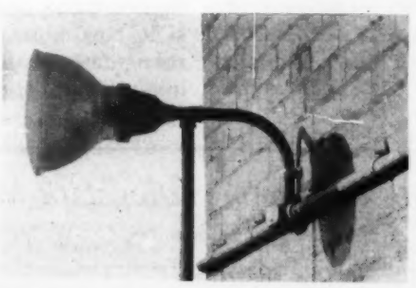
Dimming is provided by a four-element Ward-Leonard reactive dimmer of 90-kw. capacity located on the seventeenth floor. Three speed changes are provided, making possible a complete cycle of 30 seconds, one minute, or two minutes duration. Each of the four levels is provided with a pair of reactors and separate cams so that they may be dimmed simultaneously or progressively. The cams are so constructed that any desired change in sequence of dimming may be made in ten minutes. Flexibility in adjusting and changing of colors is secured by standardizing on two units, a 500-watt projector with a recess in the reflector to receive a color cap and a 1,000-watt projector which will accommodate a specially designed inner color lens. A complete change in color arrangement may be made within a very few hours. The whole arrangement constitutes in effect a big floodlighting experimental station. It is possible at any time to have a color system, a white system or a continuously changing system, and the arrangement of both color and dimming can be altered at will.

The total load on the system amounts to 262 kw., divided as follows: 419 500-watt Pittsburgh F.L.C. projectors, 48 1,000-watt

At right — One of vapor-proof units on 23d floor balcony

Below, left — 90-kw. reactive dimmer controlling white lights

Below, right — Arrangement of projectors on eighteenth floor balcony



Pittsburgh F.L.C. projectors, two 18-in. General Electric incandescent searchlights and fourteen 200-watt Holophane vapor-proof units. Normally the system is equipped with 219 Laco-Phillips color caps and 34 Laco-Phillips color lenses.

It is greatly to the credit of the manufacturers who co-operated with the lighting service department of the Philadelphia Electric Company that all of the material was manufactured, delivered, installed and adjusted within four weeks after the first order was given.

In the brief time that the system has been in operation it has excited widespread comment and already requests have been received to prepare plans for two large office buildings.

Utility Attitude on Oil Burners

POWER companies are keenly interested in domestic oil burners as a means of building up the residential load, declared Charles K. Nichols of the New York Edison Company, in an address before the recent convention of the American Oil Burner Association. They are most interested, he asserted, in the particular appliance or type of appliance that will help to improve load factor and the oil burner meets this requirement very well. About one year ago the question of the domestic oil burner as an appliance which the central-station companies should encourage came up and it was found that one large company was successfully promoting the sale of this equipment. Outlining the attitude of the power companies, Mr. Nichols continued:

"Since last summer the central stations have gone into this matter a little more carefully and in two of our largest associations, the National Electric Light Association and the Association of Edison Illuminating Companies, committees have been formed to investigate this question of oil burning and to report back, if possible, this summer or this fall, whether or not this is a matter which our companies should take on. We want apparatus that is efficient. We want apparatus that is going to function over a reasonable length of time with very little servicing.

Customer Relations a Factor

"The position of the central stations with their customers is a rather unique one. For years we have been trying to build up good customer relations. I believe that we have accomplished something along those lines, for we now find that our customers come to us and ask what apparatus they shall buy. For that reason we must be very careful to find out what apparatus there is that we can safely recommend.

"If we are handling an oil burner, if an oil burner appears on our floors for demonstration, it means that the company that has put that oil burner there, the central station that is advocating its use, tacitly guarantees that that oil burner may be used by our customers without mistake.

"In our merchandising methods there are very great differences. Some companies on one hand believe that it is advisable to select one piece of apparatus and merchandise. There are other companies which undertake to sell the idea of burning oil, advertise that, try to promote it by demonstration, have half a dozen burners on the floor, if possible, each one good, each one advertising the use of oil. There are others that will fall between those two classes, some selling them and having a manufacturer or a dealer install and service them, and merely working as an adjunct to that dealer.

A Parallel Situation

"This is the way in which the central stations have handled a business that seems to be very analogous with the oil burner. That is the domestic refrigerator. About five years ago the domestic refrigerator came rather forcibly to our attention, and for two years we investigated them, tested them, tried them out under all possible conditions, and finally in 1925 we felt that the refrigerator was here to stay, that it was no longer a luxury, that the price was such that our customers could

Number and Population of Communities with More Than One Voltage

From report of N.E.L.A. Lamp Committee (F. W. Smith, chairman)

Lighting Voltage	Number of Communities					Population of Communities (1920 Census)				
	1923	Per Cent	1928	Per Cent	Change	1923	Per Cent	1928	Per Cent	Change
110 volts only	6,976	47.7	3,751	19.9	—27.8	21,224,500	33.6	9,211,100	14.8	—18.8
115 volts only	5,226	35.6	12,879	68.2	+32.6	24,302,900	38.5	36,748,100	58.8	+20.3
120 volts only	1,197	8.2	2,088	11.1	+ 2.9	7,147,300	11.3	12,980,600	20.8	+ 9.5
Total, one standard voltage only	13,399	91.5	18,718	99.2	+ 7.7	52,674,700	83.4	58,939,800	94.4	+11.0
More than one standard voltage, one station	435	3.0	62	0.3	— 2.7	1,407,600	2.2	1,075,900	1.7	— 0.5
More than one standard voltage, more than one station	102	0.7	33	0.2	— 0.5	6,934,000	11.0	2,323,200	3.7	— 7.3
Total, standard voltage(s) only	13,936	95.2	18,813	99.7	+ 4.5	61,016,300	96.6	62,338,900	99.8	+ 3.2
112 volts only	118	0.8	9	.....	— 0.8	333,500	0.5	28,200	0.1	— 0.4
125 volts only	88	0.6	13	0.1	— 0.5	189,100	0.3	19,800	0.1	— 0.2
Other voltage below 130 volts	162	1.1	9	.....	— 1.1	667,100	1.1	5,100	.....	— 1.1
200 volts or higher	260	1.8	20	0.2	— 1.6	252,500	0.4	15,600	.....	— 0.4
Standard and odd voltages, one station	59	0.4	1	.....	— 0.4	337,000	0.6	800	.....	— 0.6
Standard and odd voltages, more than one station	16	0.1	3	.....	— 0.1	316,000	0.5	75,800	.....	— 0.5
Grand total	14,639	100.0	18,868	100.0	.....	63,111,500	100.0	62,484,200	100.0	.....

afford to buy them in large quantities, so we advocated the use of electric refrigeration very strongly, some selling one particular refrigerator, others selling the idea of mechanical refrigeration for domestic use.

"Since that time perhaps conservatively half a million electric refrigerators have been purchased and put on the power companies' lines. We still have our committees that are promoting the use of the refrigerator, and I see no reason if the oil burner is to our minds a successful piece of apparatus, as the refrigerator now is, why we cannot handle this in practically the same way.

"I believe that if we find the oil burner is a satisfactory piece of apparatus, as we believe it has been shown within the past year, the advantages of co-operation between the central stations and the oil burner companies will become more and more apparent."

Electric Annealing of Brass Shows Good Economies

RECENT experience in electric brass annealing shows advances in economy by the use of selective load control, according to a paper by R. M. Keeney before the Bridgeport meeting of the American Electrochemical Society. A representative Connecticut plant installed a 350-kw. furnace in 1924 with "on and off" control and annealed yellow brass tubing in small sizes and thin gages with a power consumption of 110 kw.-hr. per ton (2,000 lb.), or 18.2 lb. per kilowatt-hour. The inside muffle dimensions were 16 ft. by 4 ft. by 18 in. Annealing was done at a muffle temperature of 1,200 deg. F., and the outfit has been in service for nearly four years, running ten hours per day without a coil burnout or any furnace maintenance expense. The first furnace has been followed by two more 350-kw. units.

The first furnace has coils in the bottom, two sides and top of the muffle, with two control groups, each covering one-half the length of the muffle. Its production* was increased to 20 lb. per kilowatt-hour, or 100 kw.-hr. per ton, by the development of a selective† load control. The increased efficiency appears due to the more rapid absorption of heat by the mass of tubing in the furnace, because convection currents are established. This is contrary to the general opinion that all heating in an electric resistance furnace is by radiant heat and suggests that possibly mechanical circulation of a furnace atmosphere may prove beneficial in increasing the speed of annealing. The two later furnaces have four control groups each, two being in the bottom and two in the sides and arch. These additional control groups were installed because it was found that the bottom coils should be on most of the time and should be arranged for independent operation. In these two later furnaces, equipped with load control, the production is 24 lb. per kilowatt-hour, or a consumption of 83 kw.-hr. per ton.

The installation was made entirely on an economic basis, Mr. Keeney states, a large saving in pickling cost and labor having been demonstrated by experiments prior to the purchase of the first furnace. The pickling time has been reduced to about 25 per cent of the previous requirements, because there is much less oxidation of the tubing, which has cut the labor cost in two and materially reduced the acid consumption. This electric furnace installation anneals brass tubing at a cost for annealing and pickling of $2 to $2.50 per ton less than the former wood-fired muffles and results in a yearly return on about 50 per cent of the furnace investment.

*Production about 18,000 lb. per ten-hour day.—EDITOR.

†The "selective load control" keeps down demand charges and raises the efficiency of the furnace by fluxing the heat around the interior. Zones of heating are operated alternately under control of a timing device for a predetermined period (six minutes in this case), the input being shifted from one to the other as long as heat is required in both zones. When one zone reaches a cut-off point, i.e., a predetermined temperature, the furnace immediately goes off the time cycle and operates in the usual way.—EDITOR.

Planting the Electrical Idea in Fertile Soil

STUDENTS in the mechanical engineering shops at Stanford University receive their training in as modernly equipped a foundry and shop as may be found anywhere. Electric melting and heat-treating equipment installed during the past year gives the student the advantage of the best equipment and latest foundry and shop practice and he goes forth to his chosen field with a knowledge of electrical methods which better enables him to cope with such present-day industrial problems as he may encounter.

In the foundry is to be found a 100-kw. Electromelt steel furnace with a capacity of 125 lb. per hour and a Young Brothers shelf-type core-baking oven with Bristol automatic control Heat-treating equipment consists of a 30-kw. Hagan box-type heat-treating furnace with Wilson-Maculen temperature control, a 10-kw. General Electric box-type heat-treating furnace with Leeds & Northrup recording control, a Rockwell-Sentry laboratory model heat-treating furnace with carborundum heating elements and dilatometer control and a Leeds & Northrup Hump heat-treating furnace.

Electric melting and heat-treating equipment used at Stanford University in teaching modern foundry and shop practice

Markets in Brazil

Some observations by Howard A. Lewis, an American manufacturer, recently returned from a study of South American conditions

BRAZIL presents a most appealing market for American electrical products, according to Howard A. Lewis, vice-president in charge of the development of export markets for the Kelvinator Corporation of Detroit. Mr. Lewis has just returned from an extended trip to South America and brings with him some interesting observations on conditions there. He sees Brazil, from the electrical standpoint, as standing where America did twenty years ago, with this difference, that she is starting on her era of intensive electrical development with all the advantage of modern American practice at her hand.

Domestic Appliance Field Large

"The cities of Rio de Janeiro and São Paulo, the two chief centers of population in Brazil, have been electrified for years," said Mr. Lewis. He continued:

"The Pearson Engineering Company developed hydro power for both cities. With the growth of these cities there came a shortage of electricity. Recently additional hydro powers have been completed, and there is now a surplus. Nearly every home in Rio is wired. The population went from candles to electricity. The use of domestic appliances has not yet gone very far. The same condition applies in São Paulo. Rio is one of the most dramatically lighted cities in the world, miles of electrically lighted boulevards following the shore line and curve after curve of light with straight strings of illumination climbing the mountainsides. In Rio electricity has been used to beautify, in São Paulo electricity has been used for power. These two cities are now controlled by the Canadian General Finance Corporation. A progressive program is under way which will make for the greater use of electricity in the homes and in industry. A program of trade co-operation headed up by the Rio company has been inaugurated and the best of American and English association practices are being followed.

Rate Structures Being Studied

"Rates for lighting in Rio have been 800 reis or (at 12 cents the milreis) 9.6 cents American a kilowatt. The power rate starts at 500 reis or 6 cents American a kilowatt. A scientific study is now being made of the Rio rate structure, and a new domestic rate, probably with a sliding scale of charges, is soon to be set up. It is estimated that there are more than 120,000 domestic meters in Rio. In São Paulo the domestic rate is 720 reis of 8.64 cents American a kilowatt, and the power rate 200 reis or 2.4 cents American a kilowatt. The estimates give 80,000 domestic meters in São Paulo.

"There are many smaller hydro plants in Brazil. In the State of São Paulo alone it is estimated that there are more than 300 communities, large and small, served with electricity. The most important electrical development in Brazil; in fact, the most important single industrial development in the country, has been the advent of the Electric Bond & Share Company of New York. This group has already taken over Bahia, Victoria, Nictheroy and the Riberao Preto district in São Paulo. It is understood that it has options on many other desirable properties. Already it represents the largest American interest in Brazil. The program includes the building of new hydro-electric plants, the rehabilitation of existing plants, high-tension transmission and a progressive commercial development campaign. It is able to draw on the best of American experience for engineering, operation and commercial development. The existing organization is a fast-moving, modern crowd, already on a par with the best of the central-station organizations in the States. Adequate power at fair rates, with the skill to sell the idea of electricity as a labor-saving tool for industry, for the home and for agriculture, will be this organization's contribution to the growth of this empire of the south.

"There are three large electrical trading organizations in Brazil, the General Electric S. A. of Brazil, the German A.G.E. and Siemens. The Brazilian G.E. operates through seven branches, with the head office at Rio. This company manufactures lamps, and besides selling G.E. products it does some independent trading with other manufacturers. The American Westinghouse is represented by a Brazilian organization, Byington & Company. The Byington interests also control and operate light and power properties. Besides these large electrical organizations there are many smaller trading houses, handling American, English, German, Danish, French and Italian lines. For electrical apparatus and fabricated products Brazil draws from all the world.

"As for credit terms, you run the gamut in Brazil, from cash against documents in New York to consigned stocks, and anywhere in between. Local interest rates are high and much organized propaganda has been set up as to terms that must be given in order to do business. Before the financial crash of 1920-21 the American commission houses did business on a 120-day sight basis, and these terms were, up to that time, more or less standard. Today the merchandise, the salesmanship involved and the standing of the respective firms are the controlling credit factors.

Brazil Offers Opportunities

"Brazil is now entering the period of centralized and unified power station operation and control, plus the era of diversified electric applications, both commercially and domestically. What the States was electrically twenty years ago is now being repeated here. With a present population of 37,000,000 and room for 100,000,000 people, Brazil offers large opportunities for American enterprise. It should be understood by our electrical exporters, however, that this market will not be won by men who go down there and gang together with the American and English colonies. There is entirely too much of that, too much drinking and loafing by men who fail to study the national viewpoint and to become a part of the life of the country. These men are apt to fail and come back to the States to tell how hard it is to sell in South America. It is in this that the Europeon has been surpassing the American. The Latin nations of Europe have been exporting to Brazil not only dollars and goods but ideas, ideals and people who settle there and add their lives and work to the wealth of the nation. The British have sent goods and money. The Germans have sent goods, money and people. America must send ideas and sympathy, as well as dollars, plus enthusiasm, management and engineering skill, to help them build and develop the market in which we hope to share. We must forget many of our home traditions and absorb the traditions of Brazil, that we may effectively help them create a greater electrical market. No man can go there with the mere idea of exploitation and hope to succeed."

Letters from Our Readers

Dr. Stratton Misinterpreted on Maine Power Exportation

To the Editor of the ELECTRICAL WORLD:

I am very much surprised to learn of the interpretation that, according to a news item printed in your issue for June 2 (page 1163), has been placed upon my remarks at Bangor. In the first place, there was nothing whatever in my written paper concerning the Maine law as to exportation of electric power. In emphasizing the assistance that scientific and technical graduates of New England educational institutions could give in developing the industries of the State of Maine, I did remark that by keeping in touch with modern chemical and metallurgical developments they might be able to find uses for electrical current near the point of generation, where current is the principal factor in the process.

The question as to whether the law is best for the interests of the State of Maine is an economic one involving many factors, and about which I did not express an opinion.

S. W. STRATTON,
President Massachusetts Institute of Technology.
Cambridge, Mass.

Securing Accurate Results with Calculating Table

To the Editor of the ELECTRICAL WORLD:

In transmission networks the ratio of reactance to resistance is frequently so large that satisfactory results can be obtained on the calculating table by using only the value of reactance. In underground systems the ratio of reactance to resistance is smaller and much larger errors enter into the results by the neglect of the resistance. Since the voltages consumed in a network by the reactance and resistance are in quadrature it is not permissible to combine the reactance and resistance into an equivalent impedance for use in setting up the calculating table.

The following method properly allows for the quadrature relation and yields a true value for the short-circuit currents. Three steps only are involved in the solution, viz.:

1. Set up the calculating table with resistance values only and determine the current. Let it be I_r.
2. Again set up the calculating table with reactance values only and determine the current, I_x.
3. Substitute these values into the formula

$$I_{sc} = \left\{ \left[\frac{\frac{1}{I_r}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2 + \left[\frac{\frac{1}{I_x}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2 \right\}^{1/2}$$

The formula is arrived at directly, thus, $I_r = \frac{E}{R}$ and $I_x = -j\frac{E}{X}$ and also, $I = \frac{E}{Z} = \frac{ER}{R^2 + X^2} - j\frac{EX}{R^2 + X^2}$.

The "in phase" component is $\frac{ER}{R^2 + X^2}$ and the "quadrature" component is $\frac{EX}{R^2 + X^2}$

When the readings are taken on the calculating table they are $\frac{E}{R}$ and $\frac{E}{X}$ so, to establish the equalities $\frac{EK}{R} = \frac{ER}{R^2 + X^2}$ and $\frac{EK^1}{X} = \frac{EX}{R^2 + X^2}$ it is apparent that $K = \frac{R^2}{R^2 + X^2}$ and $K^1 = \frac{X^2}{R^2 + X^2}$.

So $I_{sc} = \sqrt{\left(I_r \frac{R^2}{R^2 + X^2} \right)^2 + \left(\frac{E}{X} \frac{X^2}{R^2 + X^2} \right)^2}$

$$= \sqrt{\left[I_r \frac{\frac{E^2}{I_r^2}}{\left(\frac{E}{I_r}\right)^2 + \left(\frac{E}{I_x}\right)^2} \right]^2 + \left[I_x \frac{\frac{E^2}{I_r^2}}{\left(\frac{E}{I_r}\right)^2 + \left(\frac{E}{I_x}\right)^2} \right]^2},$$

$$= \sqrt{\left[\frac{\frac{1}{I_r}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2 + \left[\frac{\frac{1}{I_x}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2}$$

The formula is simpler to use than may appear. Let the setting on resistance alone yield I_r as 1,000 and the setting on X alone yield 250 units—any units. Then in the same units,

$$I_{sc} = \left[\left(\frac{10^3}{10^6 + 16 \times 10^6} \right)^2 + \left(\frac{4 \times 10^3}{10^6 + 16 \times 10^6} \right)^2 \right]^{1/2}$$

$$= \left[\frac{10^6}{(17)^2 \times 10^{12}} + \frac{16 \times 10^6}{(17)^2 + 10^{12}} \right]^{1/2}$$

$$= \left(\frac{17 \times 10^6}{(17)^2 \times 10^{12}} \right)^{1/2} = \left(\frac{10^6}{17} \right)^{1/2} = 243 \text{ units}$$

In the analytic solution of a network the treatment can deal separately with the resistances and reactances, i.e., consider the network first as containing only resistance and then as containing only reactance, and the results be combined as indicated. This affords a check method for solutions derived in the regular way.

L. S. FOLTZ,
Head Electrical Engineering Department.
Michigan State College,
East Lansing, Mich.

Service Testing of Meter Transformers

To the Editor of the ELECTRICAL WORLD:

Referring to the article on "Service Testing of Meter Transformers" in the April 28, 1928, issue of the ELECTRICAL WORLD, I would like to call your readers' attention to the fact that this article was written before the Southern Power Company had changed its name to the Duke Power Company, hence the confusion in names.

The cost of testing was small at the time. I have checked it again this spring and it runs even less. Including time loss and overhead expenses the cost would be around $6 or $7. The cost of changing and testing was estimated on a basis of traveling considerable distances and should not average over $10 or $12. However, estimated costs differ, so they can be depended upon only when local conditions are known.

The accuracies given are high, but were obtained over several years by different men; a number of checks were made on standard transformers and their curves. Errors of potential transformers tend to balance those of current transformers and the trouble with the bad types of transformers, connections, cables, etc., were eradicated in first tests. This method has located troubles with much greater ease and rapidity than the usual method. Later tests on the meters do not show materially different results.

We would like to hear from any one who has developed methods of field testing current transformers of less than 300-amp. capacity.

BEDFORD J. BROWN,
Superintendent Meter Department.
Duke Power Company,
Charlotte, N. C.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

The Development of the Gatineau River.—The program under which the development of the Gatineau River has proceeded and the three separate projects which have been undertaken in order to complete the comprehensive scheme have been outlined. The design and operating factors involved in the three generating stations installed for the utilization of this power have been fully covered, with particular reference to the paper mill constructed as a part of the scheme and constituting an essential feature of the development. The present installed capacity amounts to 436,000 hp. The Gatineau Company has contracted to supply the Hydro-Electric Power Commission of Ontario with 260,000 hp. of 25-cycle power for its Niagara system for a period of 30 years and 100,000 hp. of 60-cycle power for its eastern Ontario district. The 25-cycle power will be supplied at 220 kv. and that for the 60-cycle system at 110 kv.—*Electrical News (Canada)*, May 15, 1928.

The Combustion of Coal.—F. H. ROSENCRANTS.—A review of the past development, the present position and the trend of progress in the use of solid fuel, with particular reference to pulverized fuel and stoker firing. It is stated that the rapidity with which the process of combustion of pulverized coal may be carried out depends upon several factors, namely, the coal should be reduced to infinite fineness; the coal and air should be preheated to the ignition temperature of the coal; the coal and air should be brought together in correct proportions and as a perfect mixture at the furnace entrance. The author adds that under these conditions combustion would be instantaneous, but that as it is neither practical nor economical to reduce coal to infinite fineness and as the ignition temperature of coal is in no case much more than 900 deg. F. little is to be gained by preheating the air beyond the more practical limit of 400 to 600 deg. F., and that in the absence of infinite or atomic fineness it is impossible to realize the intimacy of association of coal and oxygen specified as the ideal. The various factors involved have been considered, including a comparison of the advantages of the storage system and the unit pulverizer.—*Electrical Review (England)*, May 18, 1928.

Transmission, Substations and Distribution

Toronto Terminal for 220-Kv. Gatineau Power.—The new 220,000-volt step-down transformer station of the Hydro-Electric Power Commission of Ontario possesses a number of unusual features. The high-voltage lines from the Ottawa River development terminate on the 220-kv. bus at this station and may be disconnected from it by means of oil circuit breakers. Provision is made for isolating each circuit breaker by means of disconnecting switches, so that repairs may be made without interrupting service. The breakers are of unusual size and are said to be the largest in physical size and rupturing capacity yet manufactured. Complete interruption is accomplished in one-half second. The high voltage terminal of the main transformers is connected to the bus and transformation is made in the windings of the transformers to 110,000 volts and 13,200 volts. Each transformer is rated at 15,000 kv. and has three windings insulated from each other. Direct interconnection with another system is effected through 110,000-volt windings and bus construction. Synchronous condensers are employed to regulate the voltage over the 230-mile line supplying this station. — *Electrical News (Canada)*, May 1, 1928.

Cable-Laying Improvements.—E. S. BYNG.—The efficient use of labor-saving, mechanical appliances in cable-laying practices is considered in this article, one of a series on similar topics, with particular reference to British practice. The devices include compressed-air-operated tools, trench-digging machines, back fillers, tampers, concrete mixers, thrust borers, installation appliances, motor winches and pumps. It is stated that the whole economical use of any mechanical appliance depends in large measure upon the factors of cost of manual labor in relation to machine cost for a similar operation; amount of work to be done; suitability of locality for machine operations, and selection of suitable type of machine, bearing in mind capital cost and maintenance charge and also facilities for obtaining spare parts.—*World Power*, May, 1928.

Excitation Systems and Their Influence on Short Circuits and Maximum Power.—R. E. DOHERTY.—A new regulator, unique in its operating characteristics, has been developed which makes it possible to maintain stable operation under the conditions of dynamic stability, thus increasing the maximum power by taking advantage of the heretofore unexploited range of operation of synchronous machines. Comparative test results are given for different types of regulators. The new regulator indicated an extraordinary gain, giving an increase in maximum power from a steady state value from 110 kw. to a maximum of 415 kw. on a system comprising a synchronous generator supplying power directly to a synchronous motor. The excitation system as controlled by the new regulator provides a component of excitation voltage which is at all instants equal to the drop in the field circuit during the necessary small oscillations under dynamic stability. With zero effective field resistance, the maximum power corresponds to the condition of constant flux linkages, the power under that condition being greatly increased above the constant field current value.—*Journal of the American Institute of Electrical Engineers*, May, 1928.

Units, Measurements and Instruments

A Thermal Method of Standardizing Dielectric Power Loss Measuring Equipment.—J. H. SCOTT, H. W. BOUSMAN and R. R. BENEDICT.—The need for reference standards in dielectric power loss measurements at high voltage and commercial power frequencies have been reviewed and a thermal method for measuring dielectric power loss in cables utilizing the sheath temperature rise associated with the flow of heat due to the power loss within the sheath has been offered. Sources of error are discussed briefly and results are given in comparison with the measurements of dielectric power loss by the reflecting astatic, electrodynamometer wattmeter, using an air capacitor for phase-angle compensation. Certain possible errors in dynamometer measurements are noted, with particular reference to the effect of humidity on power loss in the air capacitor.—*Journal of American Institute of Electrical Engineers*, May, 1928.

Sodium-Peroxide Bomb Calorimeter.—A bomb calorimeter in which the use of oxygen for combustion purposes has been replaced by that of solid sodium-peroxide mixed with the fuel to be tested is described. It is stated that the oxygen bomb calorimeter remains the standard instrument, but that it is inconvenient for routine work and expensive. There are a number of advantages claimed for the device described in this discussion, namely, the ease with which the equipment may be dismantled and sulphur determinations made; the water equivalent of the calorimeter is determined by a test with pure benzoic acid, the calorific value of which is well known; the difference between the theoretical calorific value and the value observed to give the loss of heat by radiation and in other ways, and volatile liquid fuels may be readily tested in this device.—*Engineering (England)*, May 18, 1928.

The Microscopic Examination of Some Electrical Insulating Materials.—ARTHUR B. EVEREST.—The first test to be applied to an insulating material must obviously be directed toward ascertaining its electrical properties. Underlying the properties of any material are its composition and structure, and it is in determining these as well as in the study of defective material that microscopic examination has proved of value

to the electrical engineer in connection with his study of insulating materials. The author has undertaken a considerable microscopic examination of various materials, including insulating papers, varnished cloths and vulcanized fiber and has analyzed the influence of certain characteristics as indicated in the tests upon their value as insulating media.—*Engineering (England)*, May 18, 1928.

Illumination

Intensity of Light and Speed of Vision Studied with Special Reference to Industrial Situations—Part II.—C. E. FERREE and G. RAND.—This study is a continuation of the program outlined in an earlier paper and the investigation has been extended to include conditions of work as sampled from industrial situations supplementing the earlier determinations. In the first series of experiments described in the present discussion the effect of intensity of light was investigated for light objects on dark backgrounds and a comparison made with the effect for dark objects on light backgrounds. In the second series of experiments a color difference was introduced of a kind frequently found in industrial situations. In the third experiment the effect of intensity of light on the speed of reading a steel vernier rule was determined. Other points included are: Study of the cause of the difference in results obtained for dark objects on light backgrounds and vice versa; the measurement of the size of the pupil under certain conditions; the individual differences in speed of discriminating white and black objects on gray backgrounds, and several similar physiological determinations.—*Transactions of the Illuminating Engineering Society*, May, 1928.

Electrophysics, Electrochemistry and Batteries

Adsorption Phenomena in Primary Cells.—E. O. JEGGE.—The adsorption phenomena are stated by the author to constitute important factors in the dry cell. In this discussion the characteristics of various chemical constituents are considered and the resulting effect upon the life of the cell outlined.—*Report of American Electrochemical Society*, April, 1928.

The Development of the Process and Equipment for the Manufacture of Chemically Pure Acid by Electrical Distillation.—C. M. HOFF.—The demand for a better method for the manufacture of chemically pure hydrochloric acid led to the present investigation. Efforts were directed toward developing a continuous process, first employing fuel heating and later electrical energy for distillation. Paramount difficulty was the obtaining of materials of construction that would meet all the requirements. The result of this work was a continuous process that utilized electrical energy in place of fuel, reduced greatly the operating costs and breakage, advanced the quality of the product and improved the working conditions. This process and apparatus are also adapted, it is said, to the manufacture of chemically pure nitric acid, although introducing additional problems in the selection of materials of construction.—*Report of American Electrochemical Society*, April, 1928.

Behavior of Plating Baths and Anodes During Electrodeposition of Chromium.—RICHARD SCHNEIDEWIND and STEPHEN F. URBAN.—In this study of the behavior of chromic acid plating baths during electrolysis special emphasis has been placed on the relationship between anodes and the solution composition. If all plating conditions are kept constant, trivalent chromium in the bath approaches an equilibrium concentration, a condition of steady state. The magnitude of this concentration is a function of the following conditions: Anode current density; the nature of the anode material; temperature of the bath, and the sulphate concentration of the bath. Where iron anodes were used they dissolved at a constant rate during electrolysis. Lead is less soluble at low temperatures, but proved even more soluble at high temperatures than iron. Dissolved iron and trivalent chromium greatly contract the range of current densities at which good plate is produced.—*Report of American Electrochemical Society*, April, 1928.

Electrochemical Production of Graphitic Oxide.—BRUCE K. BROWN and OLIVER W. STOREY.—Graphitic carbon may be oxidized to a deflagrating oxide of carbon having the properties of graphitic oxide when used as an anode in a neutral or an acid electrolytic bath containing oxidizing anion. The authors conclude as a result of their investigation that dilute nitric acid with or without the addition of an oxidizing salt is the preferred electrolyte for producing electrochemical graphitic oxide. A low current density and a low temperature electrolyte are conditions required to fix the greatest amount of oxygen. Best current efficiencies and the highest percentage of fixed oxygen are obtained by using impregnated anodes. The available oxygen in graphitic oxide may be determined by the ferrous sulphate method, the available oxygen being somewhat lower than the total oxygen obtained by combustion.—*Report of American Electrochemical Society*, April, 1928.

Traction

Chicago Terminal Electrification of the Illinois Central Railroad.—R. F. SCHUCHARDT and W. M. VANDERSLUIS.—The general problem of railroad electrification has been considered with particular reference to the installation on the system of the Illinois Central in Chicago. The local conditions involved in the design and construction work of this carrier, the analysis prepared in connection with desirable sources of power supply, and the fundamentals of the contract entered into by the railroad and the power utility, are outlined by the authors. The rolling stock and method of energy distribution as well the substations and their equipment are noted, and operating experiences to date are given. It is stated that the high-speed circuit breaker is the major item of importance in the equipment and that this device has done all that was expected of it. Both in correct selectiveness and in effective current interruption its behavior is said to have been excellent. Power requirements under varying load conditions and classifications of traffic are given.—*Report of American Institute of Electrical Engineers*, May, 1928.

Miscellaneous

Strength of Interlocking-Rib Tile Walls.—A. H. STANG, D. E. PARSONS and A. B. MCDANIEL.—A number of walls were examined in the course of this investigation regarding the strength of interlocking rib tile masonry. Four walls were stressed in compression, three under transverse loading and one was subjected to a transverse load before being tested in compression. Lime, cement-lime and no mortars were used in the horizontal joints. Spaces between the terminal ribs of the tiles in the walls were grouted. The strength of the walls both under vertical and transverse loads was affected by the workmanship and the mortar beds. The wall with cement-lime mortar beds sustained a maximum transverse load about 2½ times that taken by the wall with lime mortar beds and higher than any other wall tested so far at the Bureau of Standards. A specially designed tile was used. The compressive strength of the other cement lime mortar bedded walls was about 2½ times that of the other wall with lime mortar bed.—*No. 366 Technologic Papers of the Bureau of Standards.*

Brittleness Tests for Rubber and Gutta-Percha Compounds.—By G. T. KOHMAN and R. L. PEEK, JR.—An insulated material compounded of rubber, gutta percha or of similar substances becomes brittle at a temperature characteristic of the material below which it may not be used if subject to mechanical stress. The authors have devised an apparatus for determining the temperature by giving the sample a sharp bend through a fixed angle. The highest temperature at which fracture occurs in this test has been found to be nearly independent of the bending angle and the sample's dimensions provided the rate of bending is maintained at a nearly constant rate. A modified form of this equipment is also described, by means of which the brittle temperature may be determined when the material is under high hydrostatic pressure. The constancy of the brittle temperature when determined under different conditions suggests that it marks a change in the structure of the material.—*Reprint B-287, Bell Telephone Laboratories, Inc.*

Book Reviews

Die Messwandler

By I. Goldstein. Berlin: Julius Springer, 166 pages, 130 illustrations. 1928.

The growing importance of measuring apparatus and protective relays in modern high-voltage plants and networks has increased the interest in the necessary current and potential transformers, yet the present book is the first one dealing with this subject to appear in European literature in almost twenty years. Volumes on transformers in general, while in themselves of rather infrequent appearance, find it beyond their scope to consider measuring transformers with more than a mere mention. Designers and operating engineers will therefore welcome this highly practical book, covering all phases of the subject in a concise manner. Mathematical treatment is subordinated to vector analysis and other graphical representations. The fact that the author is a member of a large German concern, and that only the products of this concern are used to illustrate the book, does not seem to lessen the general appeal of the publication. However, it does not seem logical to devote five-sixths of the book to current transformers and only one-sixth to potential transformers.

The Story of Public Utilities

By Edward Hungerford. New York: G. P. Putnam's Sons. 384 pages, 81 illustrations.

The purpose of this book is well expressed in the foreword by Mrs. Henry G. Danforth, president Board of Education, Rochester, N. Y., who says: "'The Story of Public Utilities' aims to give in as simple a way as possible a picture of the origin, the development, the general organization and the practical workings of the utilities which serve our cities and our country. It is written in the belief that the increasing importance of public utilities in home, industrial and civic life justifies the inclusion of such a study as a part of the supplementary work in the social studies and the science classes of our public school system.

"The publication of the work is in no sense a commercial venture. For this reason the copyright has been vested in the Children's Memorial Scholarship Fund, Inc., and royalties accruing from the sale of the book will be devoted to the purposes of the fund. It enables pupils to continue in school who would otherwise be obliged to withdraw from financial necessity."

The book fulfills its purpose very ably. The author, a well-known writer on travel and transportation, has treated his subject in an interesting manner, uncommon to most literature on the subject. While the book is devoted chiefly to the historical development, two chapters treat briefly the service organization, policy, financing and regulation of utilities.

The criticism made of some books on public utilities can hardly be justified in this case because the book is confined to facts and does not include discussions of argumentative subjects. No comparisons of government, municipal and private ownership or operation are made. The book has received the indorsement of the Rochester (N. Y.) Board of Education.

Electric Traction on Italian Railways

(La Trazione elettrica sulle ferrovie Italiane.) Published by the Minister of Railways and Communication in connection with the Volta Centenary in 1927. Board covers, illustrated, 194 pages and two large maps.

In a country like Italy, where coal is expensive but water powers are abundant, it is not surprising that a great deal of attention should have been paid to railway electrification. Up to Sept. 1, 1927, there had been built and put into operation by the Italian government heavy electric traction lines comprising 1,149.8 km. (718.5 miles) of route and 2,399 km. (1,499 miles) of track, and there was in course of equipment 257 km. (161 miles) of route and 744 km. (465 miles) of track.

These figures, with a great deal of other good information, are contained in a book recently issued by the Minister of Railways and Communication of the Italian government. It is divided into five sections as follows: General statistics and discussion; detailed information of the electrical equipment and distribution system of each of the lines of the State railway system; data on the sources of electric power supply; detailed information of the electric locomotives; brief information in regard to 33 interurban electric railways that do not form a part of the State railway system.

The book is very well illustrated, among the prints being two large maps. One shows all of the interurban and trunk electric railway lines in Italy. The other is on a larger scale and shows the electrified lines in the Milan-Genoa-Leghorn district, with their transmission lines.

Book Notes

ELEMENTS OF MACHINE DESIGN. By Prof. J. D. Hoffman, Purdue University, Lafayette, Ind., and Prof. L. A. Scipio, Robert College, Constantinople, Turkey. Boston, Mass.: Ginn & Company. Engineering Series, 327 pages.

Treats of the fundamental mechanics of machine construction, covering materials and forces involved in design. Mechanical driving equipment is comprehensively discussed, with practical problems set forth with unusual clarity. Nine chapters are devoted to shafting, keys, couplings, flywheels and pulleys, belt and rope drives, friction gearing, spur, bevel and screw gearing, bearings, flat plates, pipes, cylinders, joints and fastenings. Design applications are analyzed in the remaining seven chapters, featuring press, jib crane, punch, shear, overhead traveling crane, the Scotch marine boiler and the kinematics of machines.

WISSENSCHAFTLICHE ABHANDLUNGEN DER PHYSIKALISCH TECHNISCHER REICHSANSTALT. Band XI, Heft 2. Berlin: Julius Springer. 108 pages.

The latest group of papers, continuing this well-known series, again touches on many fields: Properties of materials, especially cobalt and nickel alloys; the photometry of diffusely transmitting glassware; new methods for sundry types of measurement, to mention only a few. The longest contribution reports the results of another attempt to unravel the acoustical complexities of speech sounds.

THE "ELECTRICIAN" ANNUAL TABLES OF ELECTRICITY UNDERTAKINGS 1928. By *The Electrician*. London: Ernest Benn, Ltd. 200 pages. Price, 10 shillings, net.

This book comprises data on 800 British and 1,300 colonial and foreign electrical undertakings. Details of generating plants, which were omitted during the war, have been restored and additional data included. Among the information covered are: Voltages and frequencies used; generator plant rating and system load; output; and energy rates.

STORAGE BATTERIES SIMPLIFIED. By Victor W. Page. New York: Norman W. Henley Publishing Company. 258 pages, illustrated. Price, $2.

This book is a non-technical treatise discussing the development of the modern storage battery, outlining the basic operation of the leading types. Also the methods of construction, charging, maintenance and repair. Practical applications of commercial batteries are shown and described. Includes special instructions for care and repair of automobile batteries and glossary of terms, also storage batteries for radio.

Books Received

Elektrische Vollbahnlokomotiven. By Dr. Karl Sachs. Berlin: Julius Springer. 461 pages, illustrated. Price, 84 marks.

Hochfrequenzmesstechnik. By Dr. Ing. August Hund. Berlin: Julius Springer. 525 pages, illustrated. Price, 39 marks.

Intermediate Electricity and Magnetism. By R. A. Houston. New York and London: Longmans, Green & Company, Ltd. 170 pages, illustrated. Price, $1.75.

The Story of Electricity. By Hermann Goodman. New York: Medical Life Press. 62 pages, illustrated. Price, $1.50.

Scientific Purchasing. By Edward T. Gushee and L. F. Boffey. New York: McGraw-Hill Book Company. 195 pages. Price, $3.

Electric Heating. By Edgar A. Wilcox. New York: McGraw-Hill Book Company. 569 pages, illustrated. Price, $5.

Storage Batteries. By Morton Arendt. New York: D. Van Nostrand Company, Inc. 281 pages, illustrated. Price, $4.50.

Die Physikalischen Grundlagen der elektrischen Festigkeitslehre. By N. Semenoff and A. Walther. Berlin: Julius Springer. 166 pages, illustrated. Price, 16½ marks.

Die Selbsttaig Signalanlage Der Berliner Hoch- Und Undergrundbahn. By Alfred Bothe. Berlin: Julius Springer. 164 pages, illustrated. Price, 32 marks.

News of the Industry

Republican Platform and the Utilities

Satisfaction Expressed at Indorsation of State Regulation and Reiterated Opposition to Government Ownership—Rate Feature of Muscle Shoals Bill

By Paul Wooton
Washington Correspondent of the Electrical World

NO REPRESENTATIVE of the public utilities appeared before the resolutions committee of the Republican National Convention at Kansas City last week, and it is understood that the reference to public utilities in the platform came from within the committee. The text of the utilities plank follows:

Republican congresses and administrations have steadily strengthened the Interstate Commerce Commission. The protection of the public from exactions or burdens in rates for service by reason of monopoly control, and the protection of the smaller organizations from suppression in their own field, has been a fundamental idea in all regulatory enactments. While recognizing that at times federal regulations might be more effective than state in controlling intrastate utilities, the party favors and has sustained state regulation, believing that such responsibility in the end will create a force of state public opinion which will be more effective in preventing discrimination and injustices.

In another plank, headed "Home Rule," the platform says:

There is a real need in the country today to revitalize fundamental principles; there is a real need of restoring the individual and local sense of responsibility and self-reliance; there is a real need for the people once more to grasp the fundamental fact that under our system of government they are expected to solve many problems themselves through their municipal and state governments, and to combat the tendency that is all too common to turn to the federal government as the easiest and least burdensome method of lightening their own responsibilities.

Representatives of the utilities industry are pleased with the declaration as to the advisability of state regulation, but some will take issue with the statement that federal regulation might be more effective.

It is believed that all the utilities wanted to see in the platform was a declaration against the government in business. In that they were not disappointed. At several points in the platform positive commitments are made against such a policy. In the agricultural plank, for instance, the party pledge specifies that its aid will not go to the point of putting the government into business, and in the merchant marine plank the outright statement is made that "the Republican party does not believe in government ownership or operation."

The Republican platform is silent on Muscle Shoals, Boulder Dam and federal water-power policy in general.

That feature of the Muscle Shoals bill requiring that the charge for electricity to the ultimate consumer must not exceed an amount fixed by the Federal Power Commission as reasonable, just and fair is believed to have been one of the major reasons for the President's pocket veto. The question of the constitutionality of federal regulation of electric rates was raised in Congress, and some members argued that there need be no fear of an invasion of the rights of the states as the courts certainly would find that portion of the bill unconstitutional.

The President has very decided views as to the propriety of passing legislation thought to be in conflict with the constitution. While the government operation features of the bill doubtless were highly objectionable to him, it is conceivable that he might have made concessions in that regard because of the unusual situation surrounding the properties of the government at Muscle Shoals. The President also had taken a decided position against getting the government in deeper at Muscle Shoals, and the inclusion of the Cove Creek dam in the bill doubtless had an important bearing on his action.

Had the bill become a law it is doubtful that the power companies in the South would have been willing to take any of the power because of the conditions attached to its use. It also is thought more than possible that the state commissions themselves, rather than surrender jurisdiction over an indeterminate amount of power, might decline to sanction contracts between the utilities and the federal government.

Power Commission Criticised

Some spokesmen of the power industry are much concerned over the action of the Federal Power Commission in ruling that no application for a license or an amendment to a license will be considered by the commission itself until the amounts of preliminary expenditures approved by the commission's staff for inclusion in the capital cost of the project shall have been accepted by the applicant. It is asserted that had such a regulation been put into effect with the enactment of the water-power law few important licenses would have been issued. The last annual report of the Federal Power Commission shows a long list of license cases in which the pre-license costs have not been determined. Had the new policy been in effect when these licenses were considered, they could not have been issued up to the present time. Bureaucratic supervision and legislative attacks are declared to have about reached the point where the development of water-power resources has been effectually checked.

Norris on Warpath

Nebraskan Assails "Power Trust" in Unmeasured Terms, Likening It to "Old Man of the Sea" and Comparing Its Menace to That of Slavery

IN THE July issue of a radical publication called *Plain Talk* Senator George W. Norris of Nebraska makes a violent assault upon the light and power industry—the "power trust," as he terms it—declaring it to be "riding Uncle Sam like the mythical Old Man of the Sea rode Sindbad the Sailor" and demanding government competition as "the one sure method by which its strangulation grip can be broken." "Abraham Lincoln once declared that this nation could not survive half slave and half free," the Senator says. "We settled that problem by abolishing chattel slavery. In my opinion, an analogous situation exists today—and one equally dangerous to the republican institutions of our country. If the United States government cannot control the power trust, it follows as night follows day that the power trust will control the United States government." Much more follows to the same effect.

Mr. Norris scouts the tax argument. He thinks "the government could vastly undersell private companies and yet get profit ten times as great as the lost taxes," and that if the sources of power controlled by five dominant interests—which he enumerates as the General Electric, Doherty, Morgan, Ryan and Insull interests—can be "regained by the public" and potential water-power resources fully developed, electricity will be "as freely used in the average home as running water." The Ontario Hydro system and the Tacoma (Wash.) municipal plant are invoked to support his contentions.

Senator Norris also came out immediately after the Republican National Convention with a savage attack on its platform, criticising among many other things its silence on the various matters affecting the utilities that have recently figured prominently in political news. He said: "The platform is silent as to Boulder Dam, Muscle Shoals and the 'lame duck' constitutional amendment. It says nothing about the water-power trust. In fact, it is 100 per cent perfect as judged from the power trust viewpoint."

Investigation Records Personal Opinions

Director of Missouri Committee Admits Activities That Did Not Commend Themselves to His Private Judgment—Oklahoma Committee Has Its Turn

MORE or less exploitable matter was brought to light when the Federal Trade Commission's investigation into the public utility companies was resumed on Wednesday of this week. Correspondence between J. B. Sheridan of St. Louis, director of the Missouri Committee on Public Utility Information, who took the stand, and John W. Colton of New York, former editor of *Aera*, a magazine published by the American Electric Railway Association, taken presumably from Mr. Sheridan's files, showed that the writers were personally by no means in complete harmony with all utility activities as they conceived them. Mr. Colton, for instance, had denounced "the lying, trimming, faking and downright evasion of trust or violation of trust that mark the progress toward enormous wealth of some of the so-called big men in the industry," and Mr. Sheridan had congratulated him on his protest against an alleged plan of utility companies and organizations to "brand all advocates of government ownership as reds and bolshevists." Mr. Sheridan had also expressed an academic opinion that "the man who invented private ownership was a mortal enemy of the human race."

In his testimony about his committee's work Mr. Sheridan said, according to Associated Press reports, that his organization had sought to prevent Carl D. Thompson, head of the Public Ownership League, from filling a speaking contract on a Chautauqua circuit in 1924 and that a special committee appointed to prevent him from making the speeches discussed the question of whether to "annihilate or modify" him and the latter course was decided upon. Letters also were introduced into the record to show that pressure was brought to bear on Keith Vawter, of the Redpath-Vawter Chautauqua, and that in some places Thompson was prevented from giving his lecture.

Mr. Sheridan testified that his committee expends an average of $15,700 annually. Four pamphlets on the utility industry have been furnished the heads of schools, he testified. He admitted that $50 had been paid Prof. A. S. Langsdorf of Washington University for writing a description of the pamphlets, of which 15,000 of each had been issued. The employment last year of E. J. McCausland, dean of engineering at the University of Missouri, to make speeches at $75 each and expenses at three Missouri state teachers' colleges was also put in evidence. Mr. Sheridan said he had taken an active part in promoting utility advertising in the newspapers as a means to good will.

Mr. Sheridan is reported to have frankly admitted that he used methods not in line with his own convictions.

On Thursday of last week, June 14, Fred R. Jenkins of Chicago, chairman of the educational committee of the National Electric Light Association, told of the action of a joint committee composed of representatives of his association, the American Gas Association and the American Electric Railway Association in discussing textbooks with publishers with the result that some chapters of a volume by Howard Copeland Hill of a Chicago high school which referred to public utilities were revised.

H. J. Gonden, publisher of the *Public Service Magazine* of Chicago, testified that a survey costing $105,000 was carried out under the auspices of the magazine to obtain complete information regarding ventures and experiments into public ownership of utilities. An account of the survey was published in abbreviated form and more than one thousand copies of the set of 24 volumes were distributed. Half the money for this, Mr. Gonden said, was put up by the magazine and the other half raised by subscriptions of $1,200 each taken by various utility companies and committees on information and utility publicity. Earlier in his testimony the witness had stated that the 300 shares of the preferred stock of the publishing corporation was owned by officials of public utility company or representatives of the companies.

On Friday various activities of the Oklahoma Public Utility Information Bureau in schools and colleges, on the lecture platform, in the circulation of news releases and in connection with legislation were outlined by Edward F. McKay, manager of that bureau. Mr. McKay defended the procedure of his bureau in everything that had been done, explaining that it was its prime purpose to acquaint the people of the state with public utility work. He said that he had been responsible for the establishment in the University of Oklahoma of a course in public utility and business administration. While he did not believe the news letter sent out by his committee affected editorial opinion to any great extent, he did think it was proper for the utility interests to influence public opinion in favor of private ownership if the facts presented warranted such influence. It was the effort of his organization, he said, to present the facts.

The witness denied any knowledge of money alleged to have been used as a bribe in the Oklahoma Senate. He said that the matter of a survey of textbooks in the Oklahoma schools had been called to his attention but that nothing in that direction had been done. "I think it would be a perfectly proper thing to do," he added. He testified that thousands of speeches on utilities had been made in Oklahoma during the past few years to hundreds of thousands of persons. His organization had spent from $20,000 to $30,000 a year during recent years in carrying on its work.

Commissioner McCulloch announces that public hearings will not be held between July 6 and Sept. 1, although the field work and office activities connected with the investigation will go on. The commission's fourth interim report has been issued. It is accompanied by eleven volumes of stenographic transcripts of evidence from May 15 to June 14 inclusive.

New Generating Plant Is in Prospect for New York

When the stockholders of the Consolidated Gas Company of New York City meet on July 16 to vote on the proposed absorption of the Brooklyn Edison Company they will, according to President George B. Cortelyou, who makes this announcement in a letter to stockholders, be asked to authorize plans now being completed for the erection of a generating plant to supply service to all the boroughs of the city. This plant will, if the plans are carried out, be built on the Brooklyn side of Buttermilk Channel, opposite Governor's Island, in the harbor, and on a site already owned by the Brooklyn Edison Company.

A. H. Harris Explains Sale of Mohawk Valley Company

Alleged mystery in the sale last week of New York Central Railroad holdings in the Mohawk Valley Company and New York State Railways to the E. L. Phillips power interests, involving a transfer of nearly $42,000,000, was scouted this week at Rochester by Albert H. Harris, chairman of the executive committee of the railroad. Current rumors had it that the sale was prompted by anticipation of difficulties with the Interstate Commerce Commission should the New York Central purchase power from one of its own companies to electrify its main line from Buffalo to Harmon, by the possibility that the Mohawk Valley Company's outlet for power had been cut off at the east by the Mohawk & Hudson Company, at the west by Niagara Falls power developments and at the south by the Phillips interests, and by reports that the railroad would use proceeds of the sale to retire indebtedness of the Lake Shore Railroad.

None of these alleged facts, according to Mr. Harris, was the foundation for the sale. The holders, he said, were motivated chiefly by the offer of a fair price and the fact that the New York Central is concerned first with railroad operation. "The railroad received various offers during the last five years for its holdings in the Mohawk Valley properties because of their strategic importance, but up to the last few months had given no serious thought to selling," Mr. Harris said. "No one can tell when electrification is coming since the drawback to extensive electrification has been the initial cost. The Rochester company would not be able to supply all the power needed for such a project."

Purchases and Mergers

Brooklyn Edison Stockholders Approve Merger with Consolidated Gas—Small Utility Companies Change Hands—Municipal Plant Sales Referred to Voters

STOCKHOLDERS of the Brooklyn Edison Company on June 15 signified their approval of the coming merger of the company with the Consolidated Gas Company (see ELECTRICAL WORLD for May 19, page 1033) by depositing more stock with the National City Bank of New York than was necessary to carry out the first part of the plan. Stockholders of the Consolidated Gas Company will vote on the proposal July 16.

Permission from the Public Service Commission of New York to the Syracuse Lighting Company to acquire all of the outstanding capital stock of the Seneca River Power Company and to merge that company with the Syracuse company has been granted. The Seneca River company has operated in Baldwinsville and the territory surrounding that village, which is near Syracuse.

A. A. Lowe of New York, holder of a large tract in the Adirondacks, has a 30-day option on the municipal light and power plant at Old Forge, in that section, and it is expected that he will take up the option.

The Connecticut Public Utilities Commission has approved the plan of the Connecticut Power Company to take over the Union Light & Power Company of Unionville, Conn.

Purchase by the Duke Power Company of five small utilities in North Carolina—the Caldwell Power Company of Lenoir, the Bradley Electric Company of Lenoir, the County Service Company of Lenoir, the Catawba Valley Light & Power Company of Morganton and the Burke Utilities Company of Morganton—is announced. It is said that about $1,500,000 was involved, although no generating plant forms part of the properties. Decision whether to sell to the Duke Power Company the lighting system of Huntersville, N. C., will be made by the voters on June 30.

The Mississippi Power Company has taken over the electric light system of Flora, Miss.

After three years of agitation, during which two municipal elections were held to determine whether the citizens of Charleston, Miss., wanted to dispose of their light and water plants, both defeating the proposed sale, their disposal has been settled and the Mississippi Power & Light Company will take them over for $125,000, after another election which is regarded as a mere formality shall have been held.

The City Council of Pavo, Ga., has passed an ordinance authorizing the sale of the electric light and water plant to the Georgia Power & Light Company for the sum of $30,000. Final consummation of the sale is deferred until July 1, within which time registered voters of the town may protest the sale. If 20 per cent of the registered voters do so, the matter will be disposed of by a vote of the townspeople.

An offer of $800,000 for the municipal light and water plant of Lafayette, La., by the Gulf States Utilities Company is reported. This is the second proposal made. One from the Gulf Public Service Company is to be submitted to taxpayers at a special election set for July 6.

An application to buy the electric light and power plant at Iberia, Mo., to be operated by a new company to be known as the Citizens' Electric Company, has been filed by promoters of the Citizens' Public Service Company, recently organized in Missouri.

The Lexington (Ky.) Utilities Company is reported negotiating for purchase of the Georgetown (Ky.) Water, Gas & Electric Company.

The Kentucky Utilities Company, Louisville, an Insull property, announces that through purchase on June 1 of the Kentucky holdings of the General Power & Light Company of New York it has come into possession of transmission and distribution lines in the towns of Calhoun, Corydon, Rumsey, Poole, Slaughters and Sebree, Ky. Power for this district will be supplied by the company from its generating plants at Earlington and Graham, Ky., as soon as a 15-mile stretch of 33,000-volt line can be constructed.

An offer of $44,000 has been made by the Missouri Edison Company for the power plant and waterworks system of La Grange, Mo.

In orders recently approved by the Indiana Public Service Commission the Southeastern Indiana Power Company of Indianapolis, of which Charles T. Dehore of Ohio is head, was declared a public utility and authorized to buy the Evans Electric Company for $8,288, the Suburban Light & Power Company for $30,215 and the Eastern Light & Power Company for $14,733. These properties are in Marion, Johnson, Shelby and Fayette Counties and adjacent territories. The Southeastern company has applied for permission to issue $1,200,000 in securities, in three groups of $600,000, $400,000 and $200,000, to purchase the Indianapolis & Connersville Light & Power Company, the Milroy Light & Power Company, Battle Ground Light & Power Company, Evans Electric Company and the Indianapolis & Southwestern Railroad Company.

Arrangements by which the Interstate Public Service Company will purchase the property of the Elizabethtown (Ind.) Light & Power Company have been made by stockholders.

The Greencastle (Ind.) Gas & Electric Company has been purchased by the Midland Utilities Company from J. Gordon Martin of LaPorte and associates.

An election has been called by the Town Council of Aurelia, Iowa, to vote on selling to the Iowa Public Service Company the city's electric plant and equipment and the transmission line to Cherokee.

The California-Oregon Power Company, whose operating field extends to within 40 miles of Lakeview, in southeast Oregon, has advised the council of that city that negotiations are under way for the purchase outright of the properties which now belong to the People's California Hydro-Electric Corporation in Lake County or entering a contract whereby the California-Oregon will complete the 40-mile extension and furnish energy wholesale to the other concern.

No Consolidation of Boston Edison and N. E. Power

Regarding current rumors that a consolidation of the New England Power Association and the Edison Electric Illuminating Company of Boston is contemplated, President F. D. Comerford of the former said this week that no foundation exists for these reports. "What is expected," he said, "is a consummation of arrangements now in progress for a general interchange of power between the two companies in order that the power facilities of each may be available to the other. This should result in operating economies and benefit the public served by both."

As announced under "News About Men of the Industry," Charles L. Edgar, president of the Boston Edison company, has just been elected chairman of the board of directors of the New England Power Association—to which fact the rumors alluded to probably owed their persistence.

Arkwright at Pasadena

President-Elect of Parent Body Addresses Pacific Coast Division on Service and Citizenship—Worth-While Speeches Conclude Sessions

THURSDAY and Friday sessions of the Pasadena convention of the Pacific Coast Electrical Association last week maintained the interest aroused by the earlier sessions and reported June 16 on page 1306. "The Rising Tide of Taxation" and "Putting a Soul Into the Corporation" were the subjects of addresses on Thursday morning. A. C. Joy maintained that advertising should not be defensive, explanatory or historical, because the people are not greatly interested in these aspects of the business, but rather in the comfort, convenience and service that electricity will bring to them and the price which they must pay.

At the public policy meeting in the evening P. S. Arkwright, president-elect of the N.E.L.A., took as his subject "A Citizen Wherever We Serve" and showed how through carrying service to prospective customers instead of waiting for them to make the first move, and through industrial development programs and good citizenship on the part of the corporation and its employees in the community, the industry can merit public confidence and support and fortify itself against public attack. R. H. Ballard, the chairman of the meetings, said that the electrical industry is under national attack because of its power in the fields of engineering and finance and that it must make itself so sound commercially that it will not be vulnerable to attack nor fear the invasion of government in its realm.

On Friday morning Clyde Chamblin, president of the Association of Electragists International, said that contractors and dealers are looking to the central-station companies to lead the way in establishing a sales policy so sound that it will rally the support of the entire industry. If central stations would take half the money they now spend to create good public relations outside the industry and spend it within the industry to create better trade relations, far more would be accomplished than under present policies, he declared. C. T. Hutchinson of the California Electrical Bureau reported substantial progress for the "Red Seal" movement in California.

The closing session was devoted to the affairs of the national association,

with President-Elect Arkwright presiding. C. E. Greenwood, national commercial director, asked the sympathetic support of the geographic divisions and at the same time pledged national support to regional activities. He described the plan of the sales conference group to start an industry load-building program based on a marketing survey to be made by one of the largest business development agencies in the country. Research—the study of the consumer's psychology and reaction to the uses of electricity—and the formulation of a selling plan with common-sense appeal would, with good team work, accomplish what other industries have done. A. Jackson Marshall, national secretary, told of the national organization set-up and how the association functions through its committees.

"Z" Canyon Project Gets Preliminary Permit

Federal Power Commission Also Gives Final License to Savannah River 120,000-Hp. Development — Applications Pending for a Number of Streams

A PRELIMINARY permit was issued by the Federal Power Commission on June 14 to Hugh L. Cooper for his project in "Z" Canyon on the Clark Fork of the Columbia River in Washington. About 200,000 hp. of primary power will be made available by this development. The power is to be used for commercial and public utility purposes.

The commission also has issued a final license to the Savannah River Power Company covering its development on the Savannah River above Augusta, Ga. It is planned to install 120,000 hp. at that point.

A license has been issued to the Bedford Pulp & Paper Company covering a 1,300-hp. project on the James River below Balcony Falls, Va.

Another important interconnection between two large systems is made possible by a license just issued for a 77-mile transmission line which will connect the Prospect No. 2 plant of the Pacific Gas & Electric Company with the Copco No. 2 plant of the California-Oregon Power Company. This is the second connection between these two systems.

The Alabama Power Company has requested the termination of its license covering proposed plants No. 1, No. 2 and No. 3 on the Tallapoosa River. It is understood that the decision to abandon these plants above the Cherokee Bluffs development, which it had been authorized to construct, was influenced by the increasing obstacles in the path of water-power development. The state tax on water power was an important feature. The accounting regulations of the Federal Power Commission constituted another barrier. These and other difficulties are not encountered to the same extent in the development of power by steam. For that reason the Alabama company is turning more and more to the use of steam.

The commission has approved termination of the preliminary permit issued June 16, 1926, to Ray K. Holland of Ann Arbor, Mich. The permit covered a project on Fox River in Illinois. The permittee reached the conclusion after his investigation that it would be impossible to develop water power at a cost which would allow it to compete with steam power in that vicinity.

The commission has taken formal action approving the assignment and conveyance of the rights of the Hydraulic Race Company for the diversion of 275 sec.-ft. from the New York Barge Canal to the Niagara Falls Power Company.

The Virginia-Carolina Power Company of Richmond, Va., has applied for a preliminary permit covering a project on the Roanoke River, near Boydton, Va. It is planned to construct a dam 35 ft. high, creating a reservoir with a surface area of 3,500 acres, and to install 50,000 hp.

Charles H. Lee and Romaine W. Myers, of San Francisco and Oakland, Calif., respectively, have applied for a preliminary permit covering the construction of three plants in Josephine County, Ore., on Rogue River. These plants are designated as Nos. 3, 4 and 5, applications for plants Nos. 1 and 2 having already been received. The power is to be used for public utility purposes.

The Kentucky Utilities Company of Louisville has applied for a license covering a proposed project on Kentucky River in Mercer, Woodford, Franklin and Owen Counties, Ky. It is intended to construct power houses at United States dams and locks 4, 5, 6 and 3 and to utilize the head available at such dams. These developments are to be connected by transmission lines with the existing system of the applicant and that of the Kentucky Hydro-Electric Company. The water to be taken is estimated at 11,280 sec.-ft.

S. B. Collins of Denver, Colo., has applied for a preliminary permit to cover a project on Clear Creek in Hinsdale and Mineral Counties, Colo. The development is to divert water by tunnel from the creek to a power house with 400 hp. installed capacity. The power is to be used for mills and domestic purposes.

Gardiner Wins Nomination for Governor of Maine

William Tudor Gardiner, candidate for the Republican nomination as Governor of Maine and a believer in the exportation of hydro-electric power beyond the state boundaries, provided that there shall be "proper protection to the state," received a decisive majority over the combined votes of three opponents in primaries held this week. Mr. Gardiner has advocated a referendum on the state water-power question. Governor Brewster, who has opposed any change in the law, sought the nomination for Senator and was badly defeated by the incumbent, Senator Hale.

Power Commission Licenses Are Halted

New Order Aims to Prevent Further Accumulation of Unaudited Accounts—Insufficient Personnel the Cause Given for Radical Move

AN ORDER which is expected to halt action on water-power licenses for an indefinite period was adopted by the Federal Power Commission at a recent meeting. In the past, the commission was told, the staff has had difficulty in procuring satisfactory statements of capital accounts in accord with its accounting regulations and procedure. A considerable portion of the difficulty has been associated with expenditures prior to the issuance of the license. Apparently the new order will limit the commission's work to the issuance of the preliminary permits and the granting of transmission-line and other minor licenses.

The full text of the commission's order is as follows:

ORDER No. 27.—In pursuance of the findings of the Federal Power Commission made at its meeting of May 28, 1928, namely: "That the work of the commission relating to auditing of the accounts of its licensees and to the valuation of properties which were constructed at the time license was issued is seriously in arrears and must remain so until a more adequate personnel is available for the performance of this work, and that under such circumstances it is desirable to limit as far as practicable any further accumulation of unsettled cases affecting questions of accounting and of valuation," and by authority of subsections (a), (f), (g) and (h) of Section 4 of the federal water-power act:

It is hereby ordered that from and after the date hereof no application for license, or for amendment of license which adds to the property subject thereto, shall, except in case of emergency or in cases coming within the scope of Subsection (i) of Section 10 of the federal water-power act, be presented to the commission for its approval unless and until agreement has been reached with the applicant with respect to the valuation under Section 23 of said act, in cases where the provisions of said section are applicable, of the property or properties affected by such application for license or for amendment of license, or, if such section is not applicable, with respect to the amount which, under the provisions of said act and of the rules and regulations of the commission, may, as of some definite date, properly be included in the fixed-capital accounts of the project or projects covered by such application for license or for amendment of license; and

It is further ordered that all preliminary permits hereafter issued shall contain a requirement that the permittee shall, with its application for license, submit under oath a statement in triplicate showing the

items and amounts and the total amount claimed by the applicant as the actual legitimate cost of and the actual legitimate investment in said project as applied for as of the date of such application or as of a date not more than thirty days prior thereto. Such statement shall include all items and amounts properly chargeable in whole or in part to the fixed-capital accounts of said project under the provisions of said act and of the regulations of the commission established thereunder, whether consisting of expenditures actually made, of charges accrued, or of liabilities or obligations incurred up to and including the date of such statement; and each of such items and amounts shall be supported by satisfactory evidence and shall show the nature of the service performed or of the property acquired or to be acquired, or of the charge or proposed charge, and whether such items or amounts have been actually paid or actually accrued or represent liabilities or obligations under contract, agreement or otherwise applicable to the period prior to the date of such statement.

Georgia Electrical Men Argue About Merchandising

The Georgia Electrical Association held its annual meeting at Savannah, Ga., on June 15 and 16, with central-station, manufacturing, contracting, jobbing and dealer interests represented in its registration, approximating sixty. President Charles Ludwig of Dublin was in charge of the convention. The principal addresses were made by Gordon Groover, vice-president Citizens' and Southern National Bank, Savannah; R. A. Clark, General Electric Supply Corporation, Atlanta; J. E. Mellett, J. M. Clayton Company, Atlanta, and Marshall Adams, merchandising division of the Westinghouse Electric & Manufacturing Company, Atlanta.

The meeting was somewhat enlivened by the remarks of S. M. Byck, contractor of Savannah, in the discussion of Mr. Mellett's paper, "The Contractors' Viewpoint," when he asserted that the central-station companies should be compelled to refrain from their merchandising and wiring activities, which were taking away the livelihood of the contractors. Central-station merchandising practices were defended by power-company representatives, who held that the central station had been forced into merchandising for the sake of service to its customers and to provide a market for its product and that the power companies had no desire to handle wiring work when reliable contractor facilities were available.

A noonday shore dinner, an afternoon golf tournament and an evening banquet were the entertainment features of the meeting. Deep-sea fishing on the day following the convention was enjoyed by many of the delegates.

The following officers were elected for the coming fiscal year: President, W. W. Barr, Georgia Power Company, Dublin; vice-president, T. W. Moore, General Electric Company, Atlanta; secretary-treasurer, J. J. McDonough, Mutual Light & Water Company, Brunswick.

Broad Program Furthered

Industry Sales Conference, Through Its Sales Plan Committee, Undertakes a Study of the Market and the Development of an Industry Selling Plan

IN FURTHERING its work of developing a selling program for all branches of the industry, the Electrical Industry Sales Conference, through its sales plan committee, has engaged marketing counsel to undertake immediately a research into all consumer and industry factors governing the market for adequate wiring in the home. Out of the facts obtained will be built a co-operative selling plan for early presentation to the industry. The sales plan committee selected as such counsel the J. Walter Thompson Company of New York, Chicago, Boston, Cincinnati and San Francisco. J. E. Davidson (chairman), G. E. Cullinan (vice-chairman), W. E. Sprackling, L. W. Davis, J. E. North and J. L. Ray compose the sales plan committee, which is also to function as the working contact committee through the study and development of the selling plan.

The problem of increasing the effectiveness of the house-wiring contractor is being considered as the subject of a special program for industry action and is not within the scope of the work assigned to the agency, although, of course, the house-wiring contractor will be one of the elements to be considered in the development of the main selling plan. The scope of the work for which the agency is engaged is thus stated:

1. Approaching the problem with the attitude of fundamental analysis, the necessary investigation is to be made which will provide a clear understanding of the market to be influenced, geographically and psychologically, with regard to this problem, as a basis of definite knowledge on which to proceed. This investigation will refer to the present objectives of the conference, as distinguished from a broader investigation of the whole marketing situation of the industry.

2. Interpret the findings of this investigation in the light of broad merchandising experience and with an outside viewpoint.

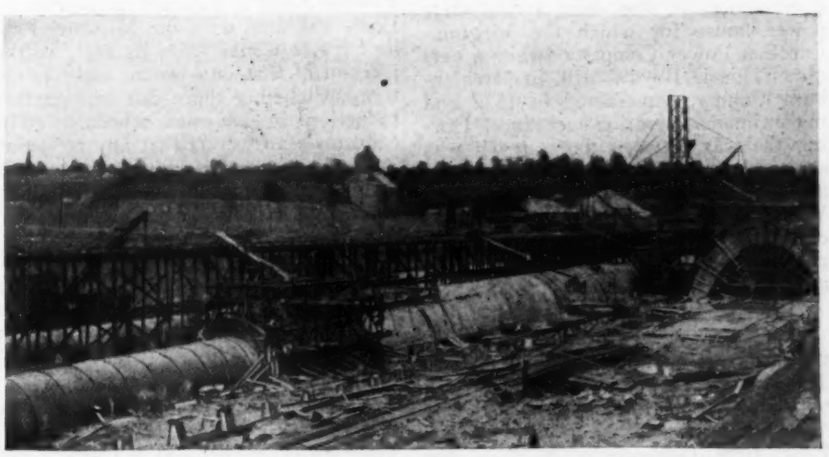
3. Prepare a comprehensive all-industry selling program founded on the conclusions reached and composed of two parts, viz.: (a) A complete and self-contained localized selling plan, suited to successful promotion and operation in any community. This would be designed as a local co-operative plan, with participation by the electric utility, jobber, contractor, dealer and manufacturer's local representatives. (b) A national phase to give a national background of advertising and publicity and to provide the bond for tying the local programs into a national movement.

It is expected that the program will be built around a new and effective approach that will grip public imagination.

4. Develop an effective plan for presenting the main selling program to the electrical industry in a way to secure the necessary financial support and participation throughout the country. The industry's existing national and local facilities would, of course, be counted on to perform their proper functions.

Funds for the preliminary investigation and development of plan have been made available by the national associations. The conference is handling the business arrangements through the board of directors of the Society for Electrical Development, and members of the staff are assisting the sales plan committee and the agency in their work.

Saluda River Dam Rapidly Getting Under Way



THE great dam to be erected on the Saluda River in South Carolina by the Lexington Water Power Company, work on which is approaching "full blast," is expected almost to transform the industrial situation in that state. It has already changed the aspect of the country up and down the Saluda River for 30 miles. One thousand farmers will have to vacate their homes. Already thousands of acres of land have been cleared of timber, and a thousand men employed by the Arundel Corporation of Baltimore, the contractor, are at work under the engineering supervision of Murray & Flood.

The dam will be 8,000 ft. in length and 208 ft. high. The lake will be 32 miles long by 14 wide. When the elevation of the lake is sufficiently high, 200,000 hp. will be available in a 60-ft. draw-down. The General Gas & Electric Company of New York has the financial responsibility for the plant.

Briefer News

NEW OFFICERS FOR VERMONT ELECTRICAL ASSOCIATION.—At the annual meeting of the Vermont Electrical Association, held this month, the following officers were elected: President, A. W. Peterson, St. Albans; first vice-president, W. H. Lawson, Rutland; second vice-president, L. A. Bill, St. Johnsbury; secretary-treasurer, L. E. Merrow, Montpelier.

POWER FOR IDAHO MINES.—Opening of the new electrolytic smelter of the Sullivan Mining Company at Kellogg, Idaho, about July 1 will require from 10,000 hp. to 12,000 hp. from the lines of the Washington Water Power Company of Spokane. This plant will be doubled in size in the future, according to announced plans. The smelter is owned jointly by the Bunker Hill and the Hecla mining interests.

ELECTRICAL PROGRESS AT SYRACUSE.—Plans for the development of a five-year program for the removal of poles and light, power and telephone cables in the congested district of Syracuse were formulated at a recent meeting at the City Hall. Removal of poles and wire has already been started in several streets by the Syracuse Lighting Company, and the New York State Railways has agreed to place some of its high-tension cables underground. The New York Central Railroad will be electrified through Syracuse, according to information received there.

LAST WATER MILL ON ROANOKE TO GO.—The last water mill operating on the Roanoke River will pass with the construction of the dam and electric power house for which the Virginia-Carolina Power Company awaits a permit. This is Boyd's Mill, in Mecklenburg County, constructed in 1837 and in continuous operation ever since. During the war between the states it was operated day and night to supply flour and meal to the Confederate forces. With its wing dam and its 1,500-ft. canal, dug by slave labor, it has been considered one of the state's picturesque and historic spots.

LOW-DAM DEVELOPMENT NEAR GOUVERNEUR, N. Y., IS BEING PUSHED.—Two hundred men are pushing work on the Eel Weir power dam a mile downstream from the outlet of Black Lake, near Gouverneur, N. Y. The plant will be in operation by October if expectations are realized. It is being erected by the St. Lawrence Valley Power Corporation and will be interconnected with the lines of the St. Lawrence County Utilities and the power distributed throughout the northern counties where the company already operates lines. The dam will be of the Ambursen type, 14 ft. high, and will have a crest length of 750 ft. The power house, which will be 117 ft. long, will be built in the bed of the river as an extension of the dam proper. The installed capacity will be 3,300 hp. in three General Electric units. A transmission line will be constructed from the power house directly to the company's power house in Ogdensburg.

WESTERN SOCIETY OF ENGINEERS HAS NEW HOME.—The annual dinner of the Western Society of Engineers in Chicago on June 13 celebrated the removal of the society into its new and larger quarters in the recently completed Engineering Building at 205 Wacker Drive. Nearly a thousand engineers were present at the dinner and listened to a program in which all of the national engineering societies were represented. The incoming president of the society, John A. Garcia, and the other new officers were introduced to the assemblage after the retiring president, Rufus W. Putnam, had reviewed the year past.

LAW AIMED AT FURTHER HYDRO-ELECTRIC PLANTS ON FOUR RIVERS IS PROPOSED IN OREGON.—An initiative measure which has for its purpose the establishment of fish reservations on four of Oregon's most important water-power resources will be placed in circulation for signatures soon, according to the Oregon Game Protective Association. The rivers affected will be the Rogue, Deschutes, McKenzie and North Umpqua. If adopted by the voters of the state, this measure may close the four streams in question to further hydro-electric development. It is the object to submit the proposed law to the voters next November.

ST. LOUIS COMPANY ANSWERS ATTACK ON ITS NEW RATES.—The Union Electric Light & Power Company of St. Louis has filed with the Missouri Public Service Commission its reply to the petition of that city for an audit to determine whether there can be a further reduction in its rate schedule. The company's answer is that any reduction in residential rates now would mean that other rates would have to be increased. In reply to the city's contention that the company should not be permitted to set up an annual depreciation charge in excess of $950,000 it is stated that the company has adhered strictly to the rate of depreciation fixed by the state commission.

SOUTHWESTERN LIGHT & POWER COMPANY FINISHES SECOND LOOP.—The Southwestern Light & Power Company has finished the second loop of its system in Oklahoma with the completion of the 6,600-volt line from Manitou Junction to Frederick, according to E. R. Ernsberger, president and general manager. The company is now closing the last gap in its third loop, extending from Duncan to Addington. A new line just completed replaces one from Walters to Temple. The line from Waurika to a pump station near Ryan has been completed. Material will be ordered next week for several lines surveys of which are now being made. They are Sayre to Erick, Granite to Willow and Brinkman, and Arapaho to Thomas.

NEWCASTLE, IND., TO BE TIED INTO CENTRAL INDIANA LOOP.—The Interstate Public Service Company has started to build a 66,000-volt single-circuit transmission line north and west of Newcastle, Ind. This line, which will be 16 miles long, will be connected with the loop of the Central Indiana Power Company at the Henry County line, thus being able to get energy from Kokomo, Lafayette and Dresser. The cost of the line is put at approximately $84,000, and an addition to the New Castle substation will cost $40,000. Yellow-pine treated poles 45 ft. high with 300-ft. spacing will be used.

TEACHERS' COLLEGE, COLUMBIA UNIVERSITY, TO HAVE COURSE ON ELECTRICITY IN THE HOUSEHOLD.—A three weeks' summer course on electricity and household electrical equipment will be held at Teachers' College, Columbia University, New York City, with the co-operation of the women's committee of the National Electric Light Association and under the direction of Dr. C. J. Lynde, head of the department of physics and household engineering of the college, from July 30 to Aug. 17. Dr. Lynde will lecture daily, with demonstrations on electricity, and nearly two hours each day will be spent in the laboratory testing household electrical equipment.

MUNICIPAL PLANT ADVOCATED FOR PADUCAH, KY.—An effort to put the city of Paducah, Ky., back into the light and power business is being made by the municipal government, which is now of the commission type. It is planning to submit to the voters in the fall a proposed bond issue for $1,000,000 with this end in view. The old power company in Paducah was purchased by the Kentucky Utilities Company in December, 1925, at which time the property was badly run down. Since that time the Kentucky Utilities has spent $615,474 on electrical equipment within the city, having virtually rebuilt the entire system. Electric rates in Paducah are today 15 per cent less than in 1914 and 29 per cent less than in 1921. Agitators for a public plant, however, think the rates should be still lower. The company is making liberal use of the advertising columns of the local newspapers in defense of its service.

GREAT WESTERN POWER BREAKS GROUND FOR NEW SAN FRANCISCO PLANT.—The Great Western Power Company of California has broken ground for its new 35,000-kw. steam generating plant on San Francisco Bay. The plant, which will cost $3,500,000 and will take a year in building, is to be the first unit of a development which will ultimately have a generating capacity of 140,000 kw. Its location is in

the southern part of the city, close to its most rapidly developing industrial section. The plant is needed primarily for standby and emergency service. The first unit will increase the steam generating capacity of Great Western to 66,400 kw. and the total hydro and steam capacity to 249,400 kw.

ELECTRICAL EXTENSION FOR BRADFORD, ENGLAND.—The Corporation of Bradford, England, has determined to install a new 30,000-kw. steam-electric plant at a cost of $1,650,000. Steam pressure of 1,100 lb. will be employed.

PROGRESS ON GREAT NORTHERN ELECTRIFICATION.—The new Great Northern Railroad track substation at Cashmere, Wash., one of three being installed between Wenatchee and the Cascade Tunnel to aid the electrification, is progressing rapidly. Similar stations will be built at New Leavenworth and Winton, and at Wenatchee, Cascade Tunnel, Scenic and Skykomish stations are now in operation. They will be used for stepping down the transmission voltage of 44,000 to the trolley voltage. When the line has been electrified the Puget Sound Power & Light Company will furnish electricity at Wenatchee, Skykomish and Tumwater. A 13,200-volt, single-phase, 25-cycle primary signal circuit is also being installed. It is expected that the transmission lines and substations will be completed by Sept. 15.

POTOMAC ELECTRIC POWER COMPANY TO ERECT OFFICE BUILDING IN DOWNTOWN WASHINGTON.—As the government's project for the beautification of the Mall requires the purchase of the property at present occupied by the executive offices of the Washington Railway & Electric Company and the Potomac Electric Power Company, these companies have acquired a tract in the downtown business section for a new office and sales building of the best type. Moving will involve a considerable task, officers of the company point out, because most of the feeder conduits from the Benning power plant run into the present office building. No decision has been reached regarding the disposal of the substation that adjoins the present building, but it is expected that this will be moved to some other location rather than the site purchased for the new building.

UTILITIES' DONATION TO JOHNS HOPKINS SCHOOL OF ENGINEERING EXPLAINED.—Dr. John B. Whitehead, dean of the Johns Hopkins School of Engineering, has issued a statement explaining the character of the fellowship of $7,500 given the university by the Utilities Research Commission of Illinois and concerning which Baltimore newspapers have made some mystery. The Illinois donor is the creation of railroad and utility companies in which the Insull interests predominate, Dr. Whitehead explained, adding: "The conditions are perfectly clear. The university has entered into an agreement to prosecute an experimental research into the problem of the insulation of high-voltage cables. This is one of the most pressing problems now confronting the engineering profession. The work is to be done under my supervision, and I am receiving no compensation. No textbooks or other material in which the comparative merits of public and private ownership of public utilities are discussed are used in connection with this work. The work is entirely in scientific research as

FIFTEEN OHIO COMPANIES FILE RURAL SERVICE PLANS.—The joint committee on rural lines policy which was set up last March at a conference of farm organization representatives and power companies of Ohio has been making a collection of the rates, schedules and rural electrification plans of Ohio power companies. Already the following companies have filed their plans with the committee: Pennsylvania-Ohio Power & Light, Ohio Power, Ohio Utilities, Ohio Edison, Wooster Electric, Southern Ohio Public Service, Cleveland Southwestern Railway & Light, Western Ohio Railway, Lake Shore Power, Toledo Edison, Columbus, Dalaware & Marion Electric, Dayton Power & Light, Southern Ohio Electric, Suburban Power and Ohio Public Service.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29; Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

Society for the Promotion of Engineering Education—University of North Carolina, Chapel Hill, N. C., June 26-29. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Empire State Gas and Electric Association—Commercial Section, Hotel Utica, Utica, N. Y., June 28 and 29. C. H. B. Chapin, Grand Central Terminal, New York.

Michigan Section, N.E.L.A.—Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Public Utilities Advertising Association —Detroit, July 8-12. T. P. Pfeiffer, Bylesby Engineering & Management Corp., Chicago.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

POWER COMPANY SUES NEW YORK CITY FOR DIVERSION OF ITS WATER SUPPLY.—An injunction suit and a claim for $750,000 against the city of New York for the alleged diversion of the waters of the Schoharie River have been filed in the Supreme Court of the state by the New York Power & Light Corporation, into which the Adirondack Power & Light Corporation was merged last fall. The power company alleges that the city, by various structures, especially the Gilboa Dam and the Shandaken Tunnel, has diverted the Schoharie from its natural channel and deprived the plaintiff of its right to use its waters. The city asserts its right to the river under legislation authorizing it to condemn lands necessary for its water supply.

CHIPPEWA FALLS HYDRO PLANT COMPLETED AHEAD OF SCHEDULE.—The Chippewa Falls hydro-electric development of the Northern States Power Company went on the line on June 15. Completion of this project, which has been described in previous issues of the ELECTRICAL WORLD, was scheduled originally for Sept. 1, but in January of this year it was deemed advisable to advance the completion date to July 1 owing to an increased demand for service. Exceptional construction progress made possible because of good weather conditions permitted this date to be anticipated by two weeks. The new hydro-electric station will provide an additional 27,000 hp. for the Northern States Power Company's Wisconsin division. It will operate synchronously with the 42,000-hp. station at Wissota.

ARTIFICIAL LIGHTNING AT 1,500,000 VOLTS TO BE PRODUCED AT STANFORD UNIVERSITY.—Artificial flashes of lightning at a potential of 1,500,000 volts, produced by an impulse generator of the type first developed by F. W. Peek of the General Electric Company several years ago, will soon be available in the Harris J. Ryan high-voltage laboratory of Stanford University in California. The generator, which is an arrangement of capacitor and resistor units, will be the first high-voltage unit to employ cable-type capacitors in place of the glass-plate type formerly used in these generators. It will be connected to the 2,000,000-volt, 60-cycle testing set put into operation in the Stanford laboratory about a year ago. The impulse voltage produced by the generator will be used in studies of high-tension transmission systems and the lightning protection problems with which they are faced. The new impulse generator was designed and manufactured by the General Electric Company at its Pittsfield plant and is at present undergoing tests at the company's high-voltage laboratory there.

Zone Rates Undesirable in Complex Territory

In the decision of the Massachusetts Department of Public Utilities establishing a general area-energy rate on the Boston Edison system (ELECTRICAL WORLD, June 16, 1928, page 1305) for residential service, the commission declared itself opposed to the establishment of zone rates under present conditions in that territory and approved the application of the company's promotional rate "B," modified as to terms, to the entire area reached by the company's lines. The Boston company serves about 41 cities and towns ranging in size from the metropolitan center to country villages and farming sections about 30 miles distant. There has lately been more or less talk about the desirability of zone rates, but the company has pursued the policy of uniform rates for residential service all over the 700 square miles of territory which make up its terrain. Discussing this matter, the board said:

We have considered whether a system of zone rates would be more equitable than treating the entire area as one district and whether it could be made effective at this time. In view of the large territory the company serves and the differences in the density of the population in the various communities, a superficial view is likely to lead one to the thought that there ought to be a differential in the price. In the consideration of the zones to be established and the differential to be applied practical difficulties are immediately encountered. The profit derived from a community is not easily, if at all, ascertainable, for the reason that the cost of supplying such a community cannot definitely be ascertained. If the customers in a city were all supplied from substations used to supply them alone, it would be possible to approximate the cost of serving the consumers in that city. This is not so, but even if it were, it would require a very long and expensive study of the cost of that part of the distribution system devoted to the distribution of electricity in each community. The company has developed its business on the basis of charging the same rate to the various customers of the same class without regard to the community in which the customer's premises are located. The distribution system of the company has been developed without regard to city and town lines, treating the area served largely as if it were one city. The rates applicable to the more densely settled portions of the territory could not be lowered without making a substantial increase in the rates in the less densely settled portions. Owing to the manifest difficulties involved in fixing satisfactory zone rates, we think it undesirable at this time to attempt to establish them.

Elsewhere in the finding the commission expressed its belief that it ought not, except in unusual circumstances, to undertake to establish the entire rate structure of any company, as the matter falls largely in the field of management. It found that no material discrimination exists today against any class of customers in the company's rate schedule. Commenting upon the decision, President C. L. Edgar of the Edison company said:

The decision is a sound one. It has adopted the form of rate which we believe is the solution of the residence-rate problem, a form in which the normal lighting requirements are measured by the floor area in the residence and energy used in excess of this small portion is charged for at very much reduced rates. The decision cuts our income a million dollars a year, but nevertheless this will in no way interfere with our dividends or with our depreciation charges. In short, the commission has adopted a sound basis of rate making and one with which we are in entire sympathy. It is a great satisfaction to us and will be a distinct benefit to our small residence customers. It does not, of course, apply to commercial customers.

Recent Court Decisions

POWER OF COMMISSION TO AMEND ITS RECORDS.—The Supreme Court of Ohio, in Helle vs. Public Utilities Commission, reversed an order of the commission which amended its own records by the insertion of an order *nunc pro tunc* (now for then). The court affirmed the right of the commission to make a *nunc pro tunc* order, but pointed out that such orders had only the province of correcting negligent or accidental omission in the case of an order actually rendered but not recorded and that such an order could not be made to correct a mistake in judgment, as had in the case under review been attempted (161 N.E. 282.)*

OHIO COURT APPROVES THE RULING OUT OF "GOING-CONCERN" VALUE AS AN ITEM IN RATE BASE.—A decision of the Ohio Supreme Court in a suit by the Portsmouth Gas Company against the Public Utilities Commission upheld the latter in a refusal to allow a specific "going-concern" value on the company's property. James W. Huffman, a commission member, says the decision has established a precedent to be followed in at least two important rate cases now before the commission affecting the Ohio Bell Telephone Company and the Logan Gas Company. In the Ohio Bell case the company claims a "going-concern" value of more than $14,000,000. The Portsmouth Gas case will probably be appealed to the United States Supreme Court by the company.

WHERE ADEQUATE SWITCHES ARE PROVIDED NEGLIGENCE CANNOT BE PREDICATED ON ABSENCE OF A PARTICULAR KIND.—Because the Circuit Court of Appeals at Baltimore held it to be proved by testimony that an electric signal maintainer on a railroad killed by electric shock while at work could have avoided the accident in any one of three different ways by using properly the switching apparatus maintained by the company, it refused, in Kreger vs. Baltimore & Ohio Railroad Company, to award damages. The claim of the plaintiff was that the company had been negligent in not providing air-break disconnecting switches rather than fuse cut-outs. The victim's neglect, or his unwarranted ignorance concerning the character of the installation, precluded the claim, which, according to the court, would have been valid had he opened the cut-outs and been injured in so doing. (25 Fed. [2d] 728.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

"ROOM RATE" AND DEMAND CHARGE.—The municipal corporation of Aledo, Ill., complained to the Illinois Commerce Commission against the rates of the Illinois Northern Utilities Company. The commission overruled the complaint and defended the "room rate" of the company, saying that such a basis of electric rates permits of the recognition of the demand feature in a rate schedule without having the effect of penalizing the consumer for the installation of extra or additional sockets and outlets, thereby encouraging the increased use of energy. The room basis, the commission observed, differentiates between the small and the large domestic consumers and permits the small householder to earn as good a rate as the large householder, a condition not easily attained under other forms of rate. It is, on the whole, favorable to the consumer, fair to the utility and just and reasonable in application. The fact that the rates of an electric company are not the same in all of the different communities served by it over transmission lines does not, the decision went on, necessarily indicate discrimination between localities. It cannot be inferred that an optional rate established in one part of the total territory served should be annulled from the mere fact that the rate is not available to the other communities served by the company.

RULES LAID DOWN TO GOVERN COMPETITION.—Adjudicating complaints made by the Public Service Company of Colorado against the city of Loveland, which owns and operates a municipal plant, the Colorado Public Utilities Commission enunciated the following principles: (1) No certificate is necessary for the construction of an electrical extension into contiguous territory not already served by another public utility of like character. (2) The failure to ask for a certificate until after an extension is constructed cannot give the utility any greater right thereto than if it had asked before, in view of the premium that would otherwise be put on the violation of the law. (3) A complaint of inadequate service by an existing utility will not be entertained for the first time in a hearing on a complaint against unauthorized competing service. (4) A utility may not single out isolated unserved inhabitants of a territory through which existing competitive service is offered as constituting together unserved territory. (5) A private utility serving four customers in a territory and offering to build other extensions on reasonable terms subject to the authority of the commission is engaged in "service" within a "territory" to the exclusion of competition from a municipal utility without a certificate. The commission held that the case did not turn upon the question whether the extension could be made by the municipal plant without using any more wire or without using a great deal more than would be required by the public utility company if it gave service to the consumers in question, but upon the question whether the territory in which the customers in question are was "theretofore served" by the private company. A public utility company complaining against an unauthorized invasion of its territory by a municipal plant is not required to show any damage or interference with it.

News About Men of the Industry

A. W. Thompson New Vice-President of N.E.L.A.

Arthur W. Thompson, who was elected a vice-president of the National Electric Light Association at the recent convention in Atlantic City, has been prominently connected with public utility activities for a number of years and at the present time is president of the United Gas Improvement Company as well as chairman of the board of the Philadelphia Electric Company, acquired early this year by U.G.I. interests. His training as an educator, engineer and railroad executive eminently qualified

A. W. Thompson

him for service in a highly industrialized territory, and when he became president of the Philadelphia Company and its affiliated corporations in 1919 he took an active part in all developments undertaken in the Pittsburgh district.

Mr. Thompson was born at Erie, Pa., in 1875 and was educated at Allegheny College, Meadville, Pa. Before completing his college course he started his railroad experience and continued to engage in that phase of public utility work until he removed to Pittsburgh. He was identified with the Baltimore & Ohio Railroad for eighteen years and during the war he was made federal manager of several large Eastern railroads. It was due to Mr. Thompson's persistent efforts that the great Colfax power plant of the Duquesne Light Company was erected to anticipate the electric power needs of the Pittsburgh district and to provide abundant cheap electric power. In addition to his affiliation with the National Electric Light Association, Mr. Thompson is a member of the American Electric Railway Association, the American Society of Civil Engineers and of other technical societies.

W. R. SMITH and P. H. ADAMS, assistant chief engineer and electrical engineer respectively of the Public Service Production Company, Newark, N. J., were among those awarded the honorary degree of electrical engineer by Clemson Agricultural and Mechanical College of South Carolina. The degrees were conferred on June 4, 1928, in connection with the dedication of the Riggs Memorial Engineering Building. Mr. Smith and Mr. Adams were both graduated from Clemson in 1906.

NICHOLAS F. BRADY, president of the New York Edison Company, arrived in New York June 19 aboard the White Star liner *Majestic* after a short sojourn abroad.

MAXWELL SAUER has resigned as chief engineer of the William Hamilton Company, Ltd., Peterboro, Ont., and has joined the Winnipeg Hydro-Electric System as designing engineer. Before affiliating himself with the William Hamilton Company, about two years ago, Mr. Sauer was designing engineer of the hydraulic department, Ontario Hydro-Electric Power Commission.

WILLIAM H. ONKEN, JR., editor of the ELECTRICAL WORLD, sailed for Europe June 22 aboard the White Star liner *Majestic* to attend as a representative of the American Institute of Electrical Engineers the dedication of the Louvain Library and Engineers' Memorial in Belgium, to be held July 4. From July 5 to July 10 Mr. Onken will be in Paris, where, as a representative of the National Electric Light Association, he will attend the convention of Union Internationale des Producteurs et Distributeurs D'Energie Electrique. Later he will visit Italy and Germany, investigating superpower and hydro-electric developments in those countries. After leaving the Continent Mr. Onken will visit Great Britain to investigate superpower developments there and to study the extent to which American capital has been used in public utility developments in that country and throughout Europe.

GEORGE C. DANIELS was appointed mechanical engineer of the Commonwealth Power Corporation of Michigan to succeed H. F. Eddy, resigned. Mr. Daniels entered the employ of the Central Illinois Light Company, one of the Hodenpyl Hardy companies, in 1910 as engineer, where he remained for four years engaging in engineering, operating and construction in connection with steam power plants. After serving as superintendent of power plants for the Central Light Company and mechanical engineer of the Central Illinois Light Company he was appointed mechanical engineer for the Hodenpyl Hardy Company, in which position he was responsible for the design, construction and operation of the steam plants of the Central Illinois Light Company, the Ohio Edison Company, the Southern Indiana Gas & Electric Company and the Illinois Power Company. He has been connected with the mechanical engineering department of the Commonwealth Power Corporation of Michigan since 1925.

W. A. Brackenridge Resigns

William Algernon Brackenridge, senior vice-president and a director of the Southern California Edison Company, has resigned. In the course of his engineering career Mr. Brackenridge has been identified with some of the most important water-power developments in the United States and since 1909 he has been an officer and director of the Los Angeles utility. In that year he was named vice-president and general manager of the company, which position he held until his election to the presidency in 1918. He served in that capacity until 1920 and at the time of his resignation

W. A. Brackenridge

was occupying the position of senior vice-president.

Following the completion of his technical education in 1877 he was engaged in an engineering capacity on the rapid transit system in New York City and later he spent some time abroad in an investigation of engineering works in England, France, Germany and Switzerland. Upon his return he was engaged by the Railroad Commission of Connecticut to make plans and surveys. After serving on the board of consulting engineers then making plans for the development of water power at Niagara Falls by the Niagara Falls Power Company, he was appointed engineer in charge of all construction for that company. In 1904 he was appointed by the Governor of New York to the advisory board of consulting engineers in charge of the construction of the Barge Canal connecting the Hudson River with the Great Lakes. During these engagements he conducted a private practice as consulting engineer, specializing on water-power development. Mr. Brackenridge will continue to serve the Southern California Edison Company in an advisory capacity.

J. P. VAN DE VOORT, assistant general counsel of the American Gas & Electric Company, has been elected vice-president. Mr. Van de Voort is a graduate of the University of Alabama and practiced law in Tuscaloosa until 1917,

when he joined the legal staff of the American Gas & Electric Company, specializing in mortgages and contracts for the interchange of power between subsidiary and other companies.

Edgar Heads New England Power Association Board

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, has been elected chairman of the board of directors of the New England Power Association, succeeding F. L. Carlisle, resigned. In announcing this change Tuesday, F. D. Comerford, president of the association, stated that Mr. Edgar has been a director of the New England Power organization for several years, and said further: "He has been an acknowledged leader in the electrical industry for many years and no one is more familiar with the problems with which the industry is concerned. His knowledge of these problems and long experience in directing the Boston Edison will be of great value to the association."

H. R. Bowie has been appointed auditor of the Pennsylvania-Ohio Power & Light Company and Pennsylvania Power Company and auditor and secretary of associated companies of the Penn-Ohio System to succeed F. E. Wilkin, who resigned to join the staff of Stevens & Wood, Inc. Mr. Bowie has been assistant auditor of the Penn-Ohio System for the last nine years.

D. J. Kennelly, who for the past six years has been superintendent of electrical construction for the Southern California Edison Company, has been transferred to the newly created position of superintendent of transmission substation operation. Mr. Kennelly joined the Southern California Edison Company in 1913 and has held successively the positions of job foreman, electrical inspector, construction department and superintendent of electrical construction.

H. F. Eddy, mechanical engineer of the Commonwealth Power Corporation of Michigan, has resigned to enter the research department of the Foster-Wheeler Corporation of New York. Mr. Eddy's identification with the Commonwealth Power Corporation and affiliated companies dates back to 1910, when the present Consumers Power Company was known as the Commonwealth Power Company. At first his work was of a general engineering nature, but later he specialized in mechanical engineering, assisting J. B. Foote in the design of the Flint, Grand Rapids, Kalamazoo and Battle Creek stations. For a period of years he was with the production and transmission department of the Consumers Power Company with duties of an operating and construction nature. When the Grand Rapids heating plant and the Saginaw River steam plant were built he became associated with the engineering force, remaining with that division until his resignation.

J. F. Owens Becomes Vice-President of N.E.L.A.

J. F. Owens, who was elected a vice-president of the National Electric Light Association at the recent convention in Atlantic City, as announced in the June 9 issue of the Electrical World, has been vice-president and general manager of the Oklahoma Gas & Electric Company for the past ten years. His renown, however, is not bounded by the State of Oklahoma, for today he is recognized nationally as one of the most beloved and capable of the executives of the light and power industry. Congenial and sympathetic by nature, he promptly established organization morale through his personal interest in the company's employees, and on this foundation he built an enviable record in the way of public relations. Outside of the electrical world Mr. Owens has an unusually wide acquaintance among representative business men of Oklahoma, having been called upon to serve in every civic campaign of importance.

J. F. Owens

Mr. Owens was born in Aurora, Ill., and was educated at the Kansas State University. Before becoming vice-president and general manager of the Oklahoma Gas & Electric Company in 1918 he had been identified with utility properties at Baldwin, Kan., and at Wagoner and Muskogee, Okla. He is a past-president of the Oklahoma Utilities Association, past-president of the Southwestern Division of the National Electric Light Association and during the past year served as chairman of the Public Relations National Section.

E. Lovette West, president of the W. S. Barstow Management Association, Inc., and for many years prominently identified with public utility interests in the East, has been elected a director of the General Gas & Electric Corporation, New York, to succeed Joseph B. Taylor.

Ernest E. Blair has been appointed purchasing agent of the Central Maine Power Company, succeeding the late Blaine Owen. Mr. Blair has been in the employ of the company since 1912 and has been acting purchasing agent since July, 1927. His headquarters will be at Augusta, Me.

V. P. Griffin, combustion engineer in the power stations department of the Duquesne Light Company since 1923, has been appointed mechanical operating engineer, supervising the operation of power station mechanical equipment.

Obituary

Albert Stetson, patent attorney, who was prominently identified with the Edison interests in England, France and this country, died June 7 at his home in Brooklyn, N. Y. While attending Tufts College Mr. Stetson became associated with Professor Dolbear, one of the early workers in telephony, and this connection was continued following graduation, taking him abroad for an extended period for scientific study. He affiliated himself with the Edison interests in Europe and spent much time in Paris and London in their employ in the early '80s. Largely as the result of this work he subsequently became a confidential expert in electrical and metallurgical matters for Grosvenor P. Lowery, of Lowery, Stone & Auerbach of New York, who was one of the counsel for the Edison interests up to the time of his death.

William T. Holmes, vice-president of the Monitor Controller Company, Baltimore, Md., died at his residence in that city June 9. Mr. Holmes was born in Philadelphia 51 years ago and had been associated with the Monitor Controller Company interests for about 25 years. For the last ten years he was vice-president of the company. Mr. Holmes was well known as a control engineer. He participated especially in the development and application of current limit control and time limit control systems which were organized by the Monitor Controller Company. His mind was particularly apt and keen in the analysis of control problems in the field—in shops and plants where electric motor control had to be applied in particular ways to accomplish specific results.

Joseph K. Choate, consulting engineer of New York, died June 19 in San Francisco of pneumonia after an illness of three days. Mr. Choate conducted an active consulting practice and since 1913 had been engaged in the management of public utility properties, particularly those of the J. G. White Management Corporation, of which he was a vice-president and director when he resigned early this year. Early in his career he did some engineering work for the New York City Department of Public Works and later engaged in railroad engineering. During his connection with the White organization he served as vice-president and director of the Augusta-Aiken Railway & Electric Corporation, director of the Georgia-Carolina Power Company and vice-president and director of the Helena Light & Railway Company.

Financial and Statistical News

Power Stocks Recover Refunding Operations Heavy

POWER and light stocks have shown their stability during the past week by a tendency to withstand the general selling movement after the liquidation of two weeks ago. With the beginning of the heavy selling which took place early in June, utility prices receded with the rest, but the downward trend seems to have halted much sooner than in most other groups. During the current week stocks such as American Gas & Electric, Pacific Gas & Electric, Detroit Edison, Middle West Utilities, Columbia Gas & Electric, etc., actually showed marginal gains, while the general market average was moving downward.

Refunding operations continue to require the great bulk of capital being currently secured by power and light companies. For the first five months of the year to date, out of some $734,000,000 raised for all purposes through public sales, refunding operations required 78 per cent. This indicates a slackening off in new building and construction programs.

Westinghouse Electric Elects New Director

At the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company held in the company's East Pittsburgh headquarters June 13 the election of four directors to serve for the term ending 1932 and a modification of the by-laws were the chief items of business transacted. Charles A. Terry, a vice-president of the company, was elected to the directorship left vacant by the death of Gen. Guy E. Tripp. The three others upon whom action was taken were re-elected. They were Joseph W. Marsh of the General Cable Company, H. H. Westinghouse of the Westinghouse Air Brake Company and Albert H. Wiggin of the Chase National Bank.

The stockholders ratified a change in the by-laws by which the fiscal year of the company now conforms with the calendar year. Instead of the fiscal year ending March 31 as formerly, it will now end Dec. 31, and the annual meeting of stockholders will be held in the future the second Wednesday in April.

Electric Investors Issues New Preferred Stock

Electric Investors, Inc., offered an additional issue of $6 preferred stock (no par value), totaling 49,000 shares, the price being 103 a share and accrued dividend, to yield over 5.80 per cent. The proceeds from the sale of this preferred stock provided funds for the retirement on June 1, 1928, of all $7 preferred stock then outstanding, for the acquisition of additional interests in electric light and power companies, and for other corporate purposes.

April Revenue $153,400,000

Income and Energy Output Six Per Cent Greater Than in April, 1927—Hydro Generation Breaks Record

WITH a revenue of $153,400,000, operating expenses of $63,200,000 and an energy output of 6,419,112,000 kw.-hr., operations of the electric light and power industry in the United States during April showed an increase of 6.0 per cent in income and virtually the same in production compared with the corresponding month last year, while the cost of operation rose less than 2.5 per cent, according to monthly reports received by the ELECTRICAL WORLD, together with energy statistics compiled by the U. S. Geological Survey.

In each respect the figure is the highest for any April in the history of the industry, although in accordance with the usual seasonal swing both the output and the revenue were smaller than during the winter months, the decrease in the latter amounting to 2.5 per cent compared with March. The rise over the corresponding month of 1927 is somewhat less than in the first three months of the year, particularly March, but this difference is partly offset by the fact that the extra day in February increased the energy consumption by more than 3 per cent, and this excess was necessarily reflected in the bills paid during the following month.

Nevertheless, April operations were close to the estimated normal based on growth in recent years. The average daily revenue was $5,110,000; the normal would have been $5,300,000; the energy averaged 214,000,000 kw.-hr.; the normal was computed to be 215,000,000 kw.-hr. daily.

Output from water power, nearly 2,822,000,000 kw.-hr., was not only the largest ever reported but also constituted the largest fraction of the total output ever reached, 44 per cent. Hydro energy, indeed, made up 80 per cent of the increase over the total output of April, 1927. The balance came from fuel-burning plants. Although the out-

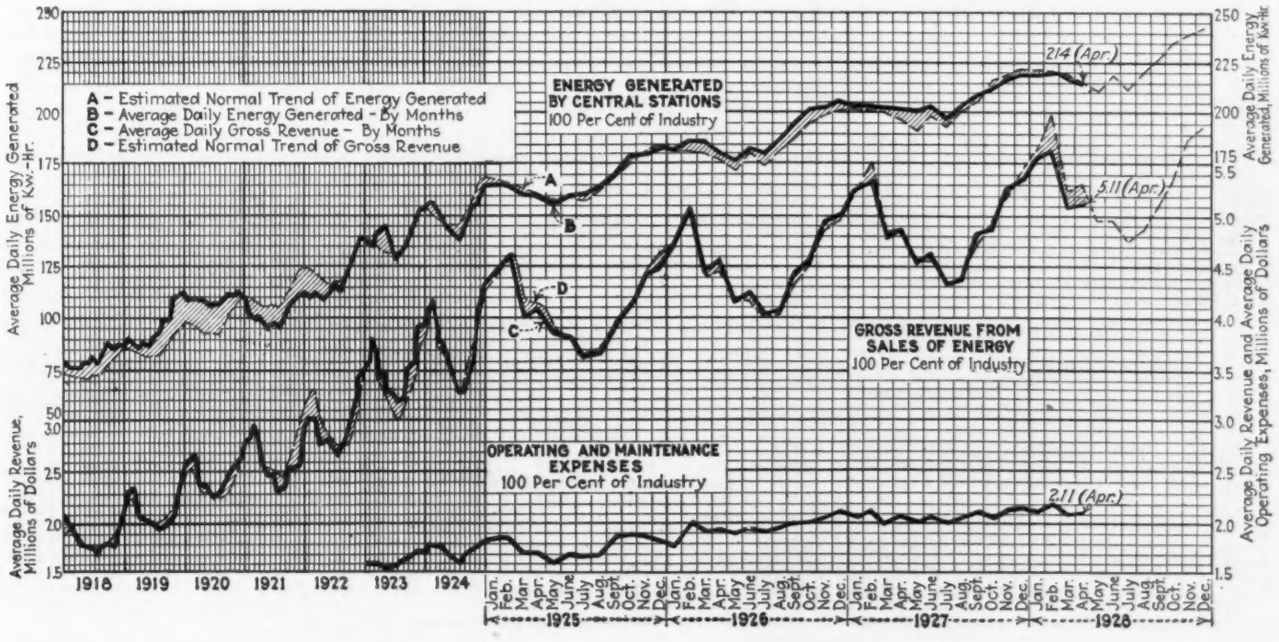

A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – By Months
C – Average Daily Gross Revenue – By Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALES OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
214 (Apr.)
5.11 (Apr.)
2.11 (Apr.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1918 1919 1920 1921 1922 1923 1924
1925 1926 1927 1928

Table I—Generation and Distribution of Central-Station Energy in the United States

(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1928 †Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
Jan...	6,767,866	6,303,199	+ 7.4	5,582,866	5,188,199	1,493,000	1,395,000	3,514,866	3,170,199	575,000	534,000	1,185,000	1,115,000	1,230,000	1,090,000
Feb...	6,402,837	5,706,468	+12.2	5,272,837	4,696,468	1,395,000	1,210,000	3,367,837	2,928,468	510,000	477,000	1,130,000	1,010,000	1,211,000	1,017,000
March	6,755,346	6,314,272	+ 6.9	5,560,346	5,194,272	1,400,000	1,305,000	3,630,000	3,304,272	530,000	503,000	1,195,000	1,120,000	1,254,000	1,084,000
April..	6,419,112	6,049,656	+ 6.1	5,284,112	4,979,656	1,323,000	1,235,000	3,461,112	3,194,656	500,000	472,000	1,135,000	1,070,000	1,137,000	1,087,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.
†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

put of the latter exceeded that of a year ago, there was a decrease of nearly 160,000 tons in the consumption of coal and a slight decrease in fuel oil, far from counterbalanced by the somewhat greater use of natural gas.

Regional changes in revenue, as indicated by the reports, are as shown in the following table:

REGIONAL CHANGES IN REVENUE

Region	Per Cent Change From April, 1927	From March, 1928
New England	+4.7	—5.2
Atlantic	+6.8	—2.6
North Central	+6.2	—3.1
South Central	+5.1	—2.9
Western	+12.0	—0.4

Changes in energy output followed the same general trend; the increase on the Atlantic seaboard was greatest in the southern portion, and a high rate in the West South Central states balanced a lack of increase in the East South Central, while both Mountain and Pacific states in the Western group reported 11 per cent increase over April, 1927.

General Gas & Electric Corporation Cuts Cost and Simplifies Set-Up

WITH a 4.3 per cent reduction in operating costs for 1927, the General Gas & Electric system was able to show a gain of 8.2 per cent in net operating revenue from an increase of less than 2 per cent in gross revenue. This is one of the few systems which has shown an actual reduction in costs for the year. The corporation itself showed a 25 per cent increase for the year both in gross revenue and in net income. This substantial growth, presumably, is what warranted the inauguration of dividends on the B stock at the rate of $1.50 per share.

The increase in revenue accruing to the parent company resulted in earnings of $5.90 per share on class A common stock. This compares with earnings on A and B stock of $3.43 in 1926 and $1.69 in 1925. Dividends on A stock commenced in October, 1925. Class A stock is currently quoted at around 41 and Class B at around 50.

The reduction in operating costs and maintenance improved the operating ratio of the group very materially, from 58 in 1926 to 54.8 last year. Property investment amounted to $5.85 per dollar of gross revenue, which makes an attractive showing among similar systems.

ELIMINATES COMPETITIVE SITUATION

In July, 1927, all securities of the North Carolina Public Service Company and the South Carolina Gas & Electric Company, owned by the corporation, and all property owned by the Broad River Power Company in North Carolina and that portion of its property in South Carolina located north and west of Union, S. C., was sold to the Duke Power Company, thereby eliminating a competitive situation which would have been very costly for both interests if continued. Benefits to the General Gas & Electric Corporation of this transaction are steadily accruing, but will not be fully apparent in its earnings until July 31, 1928.

Table II—Central-Station Financial Operations for Four Months in the United States

(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1928 Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
Jan.....	171,700	161,100	+6.6	99,500	93,600	53,900	50,200	6,600	6,600	11,700	10,700	66,700	64,800
Feb.....	162,700	151,100	+7.7	94,200	88,800	51,700	47,000	5,600	5,400	11,200	9,900	64,200	61,200
Mar.....	157,350	145,200	+8.3	90,200	85,000	50,700	45,400	5,150	5,000	11,300	9,800	64,700	62,700
April.....	153,400	144,800	+6.0	85,400	81,900	51,700	48,200	5,200	5,000	11,100	9,700	63,200	61,750

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Short Tons	1927 Short Tons	Per Cent Increase	1928 Barrels	1927 Barrels	Per Cent Increase	1928 Thousands of Cubic Feet	1927 Thousands of Cubic Feet	Per Cent Increase
January...	2,609,283	2,331,140	+11.9	4,158,583	3,972,059	+ 4.7	3,321,568	3,365,461	—1.3	560,871	786,062	—28.6	4,955,262	3,900,868	+27.0
February..	2,462,450	2,172,740	+13.3	3,940,387	3,533,728	+11.5	3,122,160	2,958,797	+5.6	521,526	646,558	—19.4	4,896,497	3,859,791	+26.8
March.....	2,727,970	2,551,792	+ 6.9	4,027,376	3,762,480	+ 7.2	3,115,814	3,090,984	+0.8	594,613	612,657	— 2.9	5,600,146	4,312,322	+29.7
April.....	2,821,758	2,526,938	+11.6	3,597,354	3,522,718	+ 2.2	2,782,356	2,942,421	—5.4	506,593	524,148	— 3.3	5,319,945	4,482,900	+18.7

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Further simplification of the corporate structure of the system was accomplished through the acquisition by the Metropolitan Edison Company of the property of the Metropolitan Power Company and the redemption of the latter's 6 per cent gold bonds. The latter step is part of a general refinancing program in which it is planned to retire all Metropolitan Edison's underlying issues and to replace them with bonds bearing a lower interest rate; also to have the Metropolitan Edison Company acquire the property and franchises of the Pennsylvania Edison Company, its principal subsidiary. This plan has been consummated during 1928.

The corporation closed the year with no bonded or floating debt. Notes payable on the consolidated balance sheet are those of subsidiary companies, which are paid off from time to time through funds obtained from the sale of securities and which represent temporary obligations pending the sale of such securities.

Expansion during the year included the installation of a 30,000-kw. unit at the Johnson City generating station of the Binghamton Light, Heat & Power Company and the completion of an interconnection of its lines with those of the Elmira Railway, Light & Water Company. The Florida Public Service Company constructed a new steam-electric generating station near Avon Park, which is interconnected with the Benson Springs station, placed in operation in 1926.

The General Gas & Electric system as at Dec. 31, 1927, served 224,208 customers. Electric sales for 1927 were 731,347,110 kw. and gas sales totaled 1,028,110,000 cu.ft. Of the operating income of subsidiaries for 1927, 85 per cent was derived from the sale of electricity, 9 per cent from gas and miscellaneous services and 6 per cent from bus and street railways. The physical properties include electric generating stations with total installed capacity of 337,398 kw-hr., approximately one-eighth hydro-electric and seven-eighths steam; also 2,207 miles of transmission lines and 3,592 miles of distribution lines. The gas properties have a 24-hour generating capacity of 9,335,000 cu.ft. and 312 miles of mains.

Savings Banks Association Advocates Private Operation

At a meeting of the mutual savings bankers of the country held last week at Swampscott, Mass., the passing of legislation in the State of New York making it possible for savings banks to invest approximately $500,000,000 in public utility securities was lauded. The committee on public utilities submitted a report which strongly upheld the principle of private ownership. The report said: "We believe that regulation is infinitely better than public ownership, and such regulation, in our opinion, should include issuance of securities, both bonds and stocks, methods of accounting, and rates to be charged for the service rendered."

The committee on uniform policies and laws submitted a report showing the four classes of property which comprise the bulk of savings banks investment are public funds, railroad bonds, public utility bonds and real estate mortgages. Some recent figures indicate that in 1922 the banks had 24 per cent of their

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 19	Low 1928	High 1928
ABITIBI PWR. & PAPER, com., new— no par	58½	57	85
Ala. Pwr., $7 cum. pf.—no par	*m*115	114	115½
Allis Chalmers Mfg.,6% com.	116½	115½	129¾
Aluminum Co. of Amer., com.	155	120	197¾
Aluminum Co. of Amer., 6% pf.	*m*108½	105½	110¼
Amer & Foreign Pwr., 7% pf.—no par	106	105½	110
Amer. & Foreign Pwr., com.—no par	32½	22½	38¾
Amer. Bosch Magneto, com.—no par	31	15¾	41
Amer. Brown Boveri Elec.†	15½	10¾	26¼
Amer. Brown Boveri Elec., pf. $7	58½	40½	65¼
Amer. Gas & Elec., 6% pf.—no par	*m*106	105	108½
Amer. Gas & Elec., com. †—no par	155	117½	184
Amer. Lt. & Trac., 6% pf.	118	116	120
Amer. Lt. & Trac., new com.	222½	170	249
Amer. Pwr. & Lt., 5% pf.	81	81	87
Amer. Pwr. & Lt., com. †—no par	75½	62½	95
Amer. Pub. Serv., 7% pf.	*a*103	97½	104
Amer. Pub. Serv., com. †	*m* 60	70	75
Amer. Pub. Utilities, 7% pfc. pf.	*a* 93½	95	97½
Amer. Pub. Utilities, 7% pr. pf.	*a*101½	95½	103
Amer. Pub. Utilities, com.	*m* 50	...	...
Amer. States Sec., A	*a* 10½	4	13¾
Amer. States Sec., B	*a* 13½	4½	17½
Amer. Superpwr., 6% 1st pf.	*f*100½	...	...
Amer.Super pwr., Class A†—no par	36	25½	56
Amer.Super pwr., Class B†—no par	38	36½	56½
Amer. Wtr. Wks. & Elec., 6% pf.—ex.div.	*m* 99	101½	106
Amer. W.W. & E., com. new—no par	55	52	70¾
Anaconda Copper cap. $3	65	53¾	74¼
Appalachian Electric Pwr., 7% pf.	109	108½	110
Arkansas Pwr., & Lt. 7% pf	107	108	109½
Assoc. Gas & Elec., $3.50—50	50	...	...
Assoc. Gas & Elec., pf.—$6—no par	92	96	98½
Assoc. G. & E., Class A, 10—no par.	48	47	52¾
BABCOCK & WILCOX, 7% com.	125	117½	128
Binghamton L., H. & P., $6 pf.	105	102	109½
Birmingham Elec., pf.—$6—no par	107	104	107
Blackstone Valley G. & E., 6% pf.	*m*107	106	112
Blackstone Valley Gas & Elec., 10% com.—50	*m*165	135	170
Blaw-Knox, com.†	*f*107½	91	108
Brazilian Trac., Lt. & Pwr.,com.,new	*f* 54	...	...
Broad River Pwr., 7% pf.	104	105	108½
Brooklyn Edison, 8% com.	237	206½	268¾
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*f*26½	....	..
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*f* 38½	.....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
Carolina Pwr. & Lt., pf.—$7—no par ex.div.	*f*108	109	111
Central & S. W. Util., $7 pf.—no par	*a*100½	99½	105½
Central & S. W. Util., pr. ln. $7 pf.—no par	*a*106½	103½	112
Central Ark. Ry. & Lt., 7% pf	106	105	107½
Central Ill. Pub. Serv., $6 pf.	*a* 99	97¼	101¼
Central Ind. Pwr., 7% pf.	*a* 99½	94	101
Central Maine Power, 6% pf.	97	96	98¼
Central Maine Power, 7%	110	109	112
Central Pwr. & Lt., 7% pf.	107	104½	114
Central States Elec., 7% pf.	117	104½	121½
Cincinnati Gas & Elec., 5% com.	*g* 99½	97½	100½
Cities Service, $6 pf.—no par	*f* 101½	94½	103½
Cities Service, pf. B—no par	*f* 9½	8¼	9¾
Cities Service, pf. BB—no par	*f* 95	88½	97
Cities Service, com.—20	*f* 71½	54	71½
Cities Service, Bks. Shrs.—10	*f* 33½	26½	35½
Cities Service Pwr. & Lt., 7% pf.	*m*107	106	109½
Cities Service Pwr. & Lt., 6% pf.	100½	95½	102
Cleveland Elec. Illg., 6% pf.	111	113	115½
Cleveland Elec. Illg., 10% com.	425	350	425
Columbia Gas & Elec., 6% pf.	106	106	110½
Columbia G. & E. com. $5—no par	103½	107½	118½
Columbus Elec. & Pwr., $2 com.—no par	*m* 79	66	79½
Columbus Elec. & Pwr., 7%	110	...	...
Columbus Ry., Pwr. & Lt., 7%	107	107	111
Columbus Ry., Pwr. & Lt., 7% pf. B	105	105	111
Columbus Ry., P.& L t. com. no par	125	120	125
Commonwealth Edison, 8% com.	*a*181	165	189
Commonwealth Pwr., 6% pf.	101½	101	104½
Commonw'th Pwr ., $2, com.—no par	71	62½	87¼
Conn. Lt. & Pwr., 8% pf.	121	120	123
Conn. Lt. & Pwr., 7% pf.	117	118	121
Cons. Gas of N. Y., pf.	102	100½	105
Cons. Gas of N. Y., com. $5—no par.	142½	119¾	170¼
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	*e*114½	110	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf.	*e*101	100½	105½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par.	*e* 81	67½	93
Consolidated Pwr. & Lt., 7% pf.	105	106	109
Consumers Pwr., 6% pf.	104½	105½	106½
Consumers Pwr., 6.6% pf.	104½	105	107
Continental Gas & Elec., 7% pr. pf.	106	106½	108½
Conti. G. & E. com. $4.40—no par	*m*240	240	265
Crocker Wheeler, com.†	63	23	70
Crocker Wheeler, 7% pf.	96	...	...
DALLAS PWR. & LT., 7% pf.	110½	110	111½
Dayton Pwr. & Lt., 6% pf.	107	108½	110½
Derby Gas & Elec., 7% pf.	101	96	100½
Detroit Edison, 8% com.	206	166½	209¾
Dubilier Condenser, com.—no par	3½	2½	5½
Duke Pwr., cap.	130	130	148½
Duquesne Lt., 5% pf.	101½	101	105½
EASTERN NEW YORK UTIL., $7 pf.	*m*110	111	112½
Eastern States Pwr. B	20½	11½	26½
Eastern States Pwr., pf.	*m*100	98	100½
East. Tex. Elec., 7% pf.	108	106	109
Edison Elec.of Boston, $12 com.	*d*275	252	305
El Paso Elec. 7% pf.	*m*112	110	112½
Elec. Bond & Share, 6% pf.	*l*110	108½	111½
Elec. Bd. & Sh. Sec., com. $1—no par	*l*100½	76	127½
Electric Household Util.†	*a* 23½	13½	27
Elec. Investors, 6% pf.—no par	102	101	104
Elec. Investors, com.†—no par	63	40½	78½
Elec. Pwr. & Lt., ctfs. pf.	108	106½	110
Elec. Pwr. & Lt., ctfs., com.—no par	34½	28½	45½
Elec. Ry. Securities, com.—no par	6½	...	...
Elec. St. Battery com. $5.25—no par	73½	69	84½
Elmira Wtr., Lt. & R.R., 7% pf.	105	105	108
Empire Pwr., pte.†	36	27½	39½
Engr. Pub. Serv. $7. pf.—no par	110½	107	110½
Engr. Pub. Serv., com.—no par	37	33	46½
Eureka Vacuum Cleaner, com. $4—no par	63	62½	79
FAIRBANKS MORSE, 7% pf.	*m*109½	104	114½
F-M., com.—$3—no par—ex.div.	38	32½	51
Federal Lt. & Trac., com. $1.40	53	42	56½
Federal Lt. & Trac., $6 pf.—no par	104	98	109
Florida Pwr. & Lt., 7% pf.	*m*105	105	108
Ft. Worth Pwr. & Lt., 7% pf.	*l*113½	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	80	75	85
Galveston-Houston Elec., com.	31½	31½	42½
General Cable, Cl.A	63½	56	84
Gen. Elec. $3 com.—no par	145	124	174½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com A $1.50—no par—ex. div.	43½	35½	50½
Gen. G. & E. (Del.) pf. A $8—no par	135	125	144
Gen. G. & E. (Del.) pf. A $7—no par	118	110	120
Gen. G. & E. (Del.) pf. B $7	114	104	117
Gen. Pub. Serv., $7 pf.	98	...	...
Gen. Pub. Serv., com., no par	22½	16½	29
General Public Utilities, $7 pf.	*m*101	98	103
Ga. Lt., Pwr. & Rys., com.	*m* 58	55	65
Gt. Western Pwr., 7% pf.	*h*104	....	....
IDAHO PWR., 7% pf.	108½	109	111½
Ill. No. Utilities, 6% pf.	*m* 99	96	100
Ill. Pwr. & Lt., 7% pf.	106½	103	107
Indianapolis Pwr. & Lt., 6¼% pf.	*m*104½	102	107½
Indianapolis Pwr. & Lt., $7 pf.	101	100	105
Ingersoll Rand com.	91½	90	98
Int. Combus. Engr., com. $2—no par	55½	45½	72¾
Int. Combustion Engr.,7% pf.	*m*105	103	109
Int. Util., Class A—$3.50—no par	*m* 48½	44½	52
Int. Utilities, Class B—no par	14½	6½	19½
Interstate Pwr., pf.—$7—no par	101	99	105
Interstate Pub. Serv., 7% pf.	106	103	108
Iowa Ry. & Lt., 7% pf.	101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf	104	105	107
Johns-Manville. com.†—no par	102	96½	134

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 20. *m*Bid price Saturday, June 16. *n*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 19	Low 1928	High 1928
KANSAS CITY POWER & LIGHT pf. $7	*m*108¾	109	114
Kansas Gas & Elec. 7% pf.	*l*109	107	110
Kelvinator Corp.	14¼	11¼	22¾
Kentucky Hydro-Elec., 7% pf.	*m*103	100	105
Kentucky Sec., 6% pf.	95	94	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	105	100	105
LACLEDE GAS LT., 10% com.	*m*200	200	260
Lehigh Pwr. Sec., com.—no par	*n* 65	19¼	65
Long Island Ltg., 7% pf.	110½	109¾	112½
Long Island Ltg., 6% pf.	*m*106	107	109
Long Island Ltg., com.†—no par	*m*250	170	250
Los Angeles Gas & Elec., 6% pf.	111	105	112
Louisville Gas & Elec., cl. A. $1.75	34¼	28	41
MAN. ELEC. SUPPLY, cap. $5—no par	55	50	66¾
Maytag Co., com. 50—no par	19	18½	22
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	108	103	109½
Metropolitan Ed., pf.—$7—no par	109	109	111½
Metropolitan Ed., com. $5—no par	165	125	185
Middle West Utilities, 6% pf.	*a* 97½	93¾	100½
Middle West Util., 6% pr. lien	*a*104	99	108
Middle West Util., com. $7—no par	*a*145	123½	169
Midland Utilities, pr. ln. 7% pf.	*a*105½	104	107
Midland Utilities, 7% pf. A	*a* 90½	89¼	92½
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*108½	110	111½
Miss. River Pwr., 6% pf.	*m*111	94	112½
Mohawk Hudson Pwr., 1st pf.—$7—no par	109½	107½	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	*m*105	100	109
Mohawk Hudson Pwr., com.—no par	39½	29½	53
Montana Pwr., 5% com. ex. div.	*m*162½	102¾	175
Montreal Pwr., 7% com.	*l*100½	....	....
Mountain States Pwr., 7% pf.	*m*103	97	105
Mountain States Pwr., com.†	18¼	....	....
NASSAU & SUFFOLK LTG., 7% pf.	109	98	110½
National Carbon, 8% pf.	*a*137	136½	139¾
National Elec. Pwr., A†	*a* 32½	27¼	42
National Pwr. & Lt., pf.—7%	107½	107¾	111
National Pwr. & Lt., com.†—no par.	33¾	21¼	36¾
National Pub. Serv., 7% pf.	102	99	104
National Pub. Serv., 7% ptc., pf.	*n*114	....	....
National Pub. Serv., A com. $1.60—no par	28½	22	29¾
National Pub. Serv., B com.—no par	29½	22	29¾
Nebraska Pwr., 7% pf.	*l*108½	110	111½
Nevada-Calif. Elec., com.	*m* 50	33½	50
New Brunswick Pwr., 4% pf.	62	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	110	98½	110½
New Eng. Pub. Serv., pf. $7	98	95	108
New Orleans Pub. Serv.—7% pf.	107½	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	102	91	104
N. Y. Central Elec., 7% pf.	105	101	107
New York Power & Light 7% pf.	114	....	....
NiagaraFalls Pwr., 7% pf.—25	*m* 27½	27½	29½
No. Amer., 6% pf.—50	54½	53¾	55¾
No. Amer., com.—10	68	58¾	78¼
No. Amer. Edison, $6 pf.—no par	*m*101½	100¾	105¼
Northeastern Pwr., com.	26½	19¼	31
No. N. Y. Utilities, 7% pf.	108	103	109
No. Ohio Pwr., com.—no par	25¾	18	32
Northern Ohio Pwr. & Lt., 6% pf.	100	90	100
No. Ont. Lt. & Pr. 6% pf.	*m* 98	94	100
No. States Pwr. (Del.), 7% pf.	109½	108¼	110¼
No. States Pwr. (Del.), 8% com.	133½	123	152
No. Texas Elec., 6% pf.	55	45	70
No. Texas Elec., com.	19	....	....
OHIO BRASS, com. B $4—no par.	*m* 94	89	100½
Ohio Brass, 6% pf.	*m*105	106	111
Ohio Pwr., 6% pf.	108	104	109½
Ohio Pub. Serv., $6 pf.	104	95	105
Ohio Pub. Serv., 7% pf.	111	107	112
Ohio River Edison, 7% pf.	109	106	109¾
Oklahoma Gas & Elec., 7% pf.	109	106	115½
PACIFIC Gas & ELEC., 6% pf.	26½	26¼	30
Pacific Gas & Elec., 8% new com.	46½	43¼	53¼
Pacific Pwr. & Lt., 7% pf.	*l*109½	106	110
Packard Electric	*k* 66	47	68¼
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 80	79¼	82
Penn-Ohio Edison, 6% pf. no par	97½	93¼	101
Penn-Ohio Edison, 7% pf.	107	105	109
Penn-Ohio Pwr. & Lt., 7% pf.	105	99	112
Penn Pwr. & Lt.—$7—no par ex. div.	*l*108½	109½	110½
Penn Wtr. & Pwr., $2.50 com., new ex. div.	*c* 79	68	90
Phila. Co., 5% pf.—50	*m* 48	45½	48½
Phila. Co., 6% pf.—50	53	52	57
Phila. Co., com.—50	*m*164	145	174½
Phila. Elec., 8% com.—25	*c* 66	55½	74¾
Portland Elec. Pwr., 7% pf.	104	100	106
Portland Elec. Pwr., 6% pf.	94	78	96
Portland Elec. Pwr., 6% 2d pf.	83	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*j*111½	....	....
Pwr. Sec., pf.—no par	60	50	68
Pwr. Sec., com.—no par	*m* 14½	11¼	14½
Public Serv. of Colorado, 7% pf.,	107	....	....
Pub. Serv. of N. J., 6% pf.	110½	103¾	115
Pub. Serv. of N. J., 7% pf.	127	118	129½
Pub. Serv. of N. J., $2 com.—no par	52½	41¼	66¾
Pub. Serv. of No. Ill., 6% pf.	*a*119	110	119
P. S. of No. Ill., com. $8—no par	*a*185½	159½	190½
Pub. Serv. of No. Ill., $8 com.	*a*181	139¾	190
Pub. Serv. of Okla., 7% pr. ln.	109	100	107
Pub. Serv. Elec. & Gas, 6% pf.	107½	107½	110½
Puget Sound Pwr. & Lt., 7% pf.	*m*110	105	110
Puget Sound Pwr. & Lt., $6 pf.—no par	101½	92	105½
Puget Sound Pwr. & Lt., com.	80	34¼	87
RADIO CORP. OF AMER., $3.50 pf.—50	56	54½	60
Radio Corp. of Amer., com.—no par.	161½	85½	224
Rochester Gas & Elec. 6% pf. D.	105½	105½	106½
Rochester Gas & Elec., 7% pf. B.	107	105	108
Rochester Gas & Elec., 6% pf. C.	104	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	117	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*m* 75	70	75
Servel, Inc.	14¼	4¼	17½
Sierra Pacific Elec., 2% com.	38	29	40½
Sioux City Gas & Elec., 7% pf.	104	100	108½
Southeastern Pwr. & Lt., pf.—$7 no par	*l*107½	....	....
Southeastern Pwr. & Lt., ptc. pf.	*l* 88	....	....
Southeastern Pwr. & Lt., com.—no par	49½	40¾	61
So. Calif. Edison, 8% pf.	49	38½	53
So. Calif. Edison, 7% pf.	28½	28½	30
So. Calif. Edison, 6% pf.	26½	25½	27¾
So. Calif. Edison, 8% com.	45½	43½	53½
Southern Cities Utilities, 7% pf.	83	75	92
Southwestern Lt. & Pwr., A $3.	70	60	80
Southwestern Lt. & Pwr., B.	50	....	....
Southwestern Lt. & Pwr., $6 pf.	90	88	96½
Southwestern Pwr. & Lt., 7% pf.	*m*111	103	115
Standard Gas & Elec., 8% pf., ex. rts.	69½	65	71½
Standard Gas & Elec., 7% pr. pf.	113½	108	115
Standard G. & E., com. $3.50	63½	57¼	74¾
Standard Power & Light, com.	*m* 53½	29¾	58½
Standard Pwr. & Lt., 7% pf.	105	103½	107½
Staten Island Edison, pf.—$6—no par	98	99	103½
Superheater, $6 com.—no par	150	149½	178
Syracuse Lighting, 7% pf.	110	103	112½
Syracuse Lighting, 8% pf.	*m*120	114	121
TAMPA ELEC., com. $2	64	62	71
Tenn. Elec. Pwr., 6% pf.	101	92	103
Tenn. Elec. Pwr., 7% pf.	109	107	110
Tex. Pwr. & Lt., 7% pf.	*l*113	113½	115
Tide Water Pwr., 8% pf.	108	108	112
Timken Roller Bear., com.—$4 no par	118	112¾	134
Toledo Edison, 7% pf.	109	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*m*145	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*132	114½	149¾
United Lt. & Pwr., pf.—$4—no par.	*a* 57	53	58
United Lt. & Pwr., pf.—$6.50—no par	101	95	101½
United L. & P., com. A 48—no par	21½	13¾	26¾
United L. & P., com. B 48—no par.	*a* 27½	20	31
Utah Pwr. & Lt., 7% pf.—ex. div.	*l*108	109½	112
Utica Gas & Elec., 7% pf.	104	105	106½
Utica Gas & Elec., 8% com.	*m*200	215	225
Utilities Pwr. & Lt., 7% pf.	100	98	104
Utilities Pwr. & Lt., com. A $2.	36¼	28½	45¼
Utilities Pwr. & Lt., com. B $1—no par	28	18½	32¾
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	108½	107½	114½
Virginia Public Service 7% pf.	104	103½	103½
WAGNER ELEC., 7% pf.	*n*106½	96¾	107
Wagner Elec., com.—no par	*b* 78	37	120
Washington Ry. & Elec., 7% com	*j* 450	....	....
Washington Ry. & Elec., 5% pf.	*j*100	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 7% pf.	109	108	115
West Penn Elec., Cl. A $7.	106	105	112
West Penn Pwr., 7% pf.	116	114¾	117
West Penn Pwr., 6% pf.	*m*1 0	108	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	98	105
Western States Gas & Elec., 7% pf.	99	100	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com. —50	91¾	88¼	112
Weston Elec. Instrument, Cl. A $2 —no par	33¾	30¼	36¾
Weston Elec. Instrument, com.—no par	22	12¼	28¼
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A.	*m* 49	46¼	58¾
Worthington Pump, 6% B.	44½	41	51
Worthington Pump, com.	29	28	37¾
YALE & TOWNE com. $55—25.	70	68¼	84¼

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 20. *m*Bid price Saturday, June 16. *n*Latest quotations available. †Dividend rate variable.

assets in public funds and only 16.6 per cent in 1927. The investment in railroad bonds decreased from 21 per cent to 15.7 per cent. Public utility investment increased from 7.1 per cent to 12.3 per cent and real estate mortgages increased from 32.9 per cent to 42.1 per cent.

Chicago Utility to Issue Additional Common Stock

At a meeting to be held Aug. 2, the stockholders of the Public Service Corporation of Northern Illinois will vote on increasing the authorized no-par common stock from 200,000 to 300,000 shares. The additional stock will be offered to common and preferred stock holders at $100 a share to the extent of one share for each five shares held. Proceeds are to be used to reimburse the company's treasury for additions to property already made and to provide funds for projected additions and betterments to the company's property.

TWO HOLDING COMPANIES PAY INITIAL DIVIDENDS ON PREFERRED.—Directors of the American Power & Light Company have declared an initial quarterly dividend of 62½ cents a share on the $5 preferred stock, series A. This issue of preferred stock is entitled to cumulative dividends at the rate of $2.50 a share for the balance of the year 1928, $3 a share during 1929, $3.50 a share during 1930, $4 a share during 1931 and thereafter at the rate of $5 per share annually. This stock was issued to holders of Montana Power Company common stock in the ratio of two preferred shares for each Montana Power common share held. The directors of the American Superpower Corporation have declared an initial quarterly dividend of $1.50 per share on the new $6 cumulative preferred stock (no par value), payable July 2 to holders of record June 15. This stock was recently distributed to the common stock holders in the form of a 20 per cent stock distribution.

PUGET SOUND UTILITY PAYS INITIAL PREFERRED DIVIDEND.—The directors of the Puget Sound Power & Light Company have declared an initial dividend of $1.05 per share on the new $5 cumulative prior preference stock (no par value), payable July 16 to holders of record June 15. The directors also declared the regular quarterly dividend on the $6 preferred.

Business News and Market Conditions

Middle Atlantic Shows Increased Construction

Volume for the United States in 1928 Is 25 per Cent Greater Than for the Same Period of 1927

DURING the five weeks of May, 1928, engineering construction volume reached a total of $357,059,000. On the basis of average weekly lettings the construction industry showed the same activity as in May, 1927, and was about 5.6 per cent lower than in April of this year, according to the *Engineering News-Record*. The value of contracts awarded this year to date is 25 per cent ahead of last year.

The Middle Atlantic states lead in the percentage increase over the first five months of 1927. This year contracts exceeded those of a year ago in that section by 66 per cent. The South showed a substantial increase of 31 per cent; New England, 18; Middle West, 14, and west of the Mississippi, 2 per cent above a year ago. The far West showed the only decline. Contracts were 12 per cent lower than last year for that section.

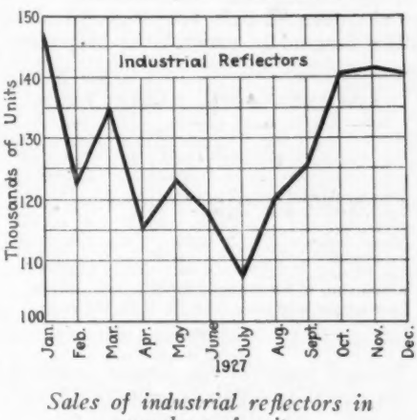
All classes of construction showed larger five-month totals in 1928 except sewers, excavations, federal government and private unclassified work. The outstanding increases in awards were made in streets and roads (62 per cent) and in private commercial buildings (33 per cent). This year is 26 per cent ahead of last for all private construction and public awards are 23 per cent greater than in 1927.

Commercial buildings constitute the largest class of construction as measured by value of contracts; the section in which the greatest expenditures for all construction are made is the Middle Atlantic. Average monthly awards for private commercial buildings in this section in 1928 has been $71,461,000, while the average month for all 1927 was $44,380,000. There is, however, no indication or suggestion of overconstruction in the increasing rapidity with which these large commercial buildings, both residential and commercial, are being built. Rents have been practically unchanged in New York City within the last three years, and there was a continual increase in rents since 1915. Average rents for the whole country have been declining since the high point reached in December, 1924.

Compared with average weekly contract awards in April, 1928, May showed an increase only in New England. Two exceptionally large waterworks contracts in Massachusetts contributed to the total. Very small decreases were shown in the Middle West and west of the Mississippi. The construction volume index number for May was 299. In April it was 312.

Classes of construction for which contract values exceeded the weekly rate a month ago were water-works, bridges, excavations, industrial buildings and federal government work. Two conspicuous bridge awards were the Lake Champlain bridge from Crown Point, N. Y., to Chimney Rock, Vt., and a railroad bridge over Newark Bay. The contract value for the former was $920,177 and the total value of the latter structure will be $7,500,000.

N.E.M.A. Statistics



Sales of industrial reflectors in numbers of units

(Other statistics collected by the National Electrical Manufacturers' Association appeared in previous issues.)

Markets for Equipment in Western Europe

Exports of electrical machinery from the United States to the whole of Europe were valued at $1,826,900 in 1926 and at $3,047,800 in 1927. Exports to western Europe amounted to $1,501,700 in 1926 and to $2,383,100 in 1927. During the year 1926 the United States exported $84,226,000 worth of electrical apparatus, of which $10,341,440, or 12.26 per cent, went to European countries. A survey of the exports of electrical machinery and apparatus during the four years 1923 to 1926 reveals the fact that an average of 16 per cent of the total found its way to European markets, but our exports of such material to Europe have dropped consistently since those countries have recovered from the loss of trade following the World War. The fact that our total exports of electrical equipment are increasing each year, while exports to Europe are slowly falling off, may be attributed in some degree at least to the fact that a greater effort is being made to develop other markets, such as Latin America, where competition is less keen.

Generally speaking, France, Spain and the United Kingdom are our best European markets for industrial electrical appliances. Rather a large proportion of our exports of accessories and parts for motors go to Belgium and Italy, and even Norway imports a good deal of this equipment, while of our shipments of small motors a large percentage finds its way to Germany. The Netherlands, Sweden, Switzerland, Italy and Belgium also import small motors to a considerable extent. Trade with Russia is steadily improving, exports of industrial electrical appliances to that country for 1925 and 1926 showing a marked gain over the two preceding years.

A survey of the world markets for electrical goods in 1923 shows that Great Britain, the United States and Germany together supplied 80.6 per cent of the world requirements of

Value of Contracts Let in the United States and Canada During May, 1928

Thousands of dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to date, U. S.	Canada
Waterworks	$8,964	$1,342	$239	$510	$859	$1,691	$13,605	*$24,519*	$23
Sewers	119	1,218	384	6,183	1,077	1,350	10,331	*38,837*	497
Bridge	805	10,573	1,884	4,053	2,340	984	20,639	*58,560*	375
Excavations, drainage, etc	70	353	324	664	122	.....	2,133	*7,363*	.....
Streets and roads	3,655	22,974	8,539	28,351	12,997	6,903	83,419	*265,279*	1,833
Industrial buildings	7,057	6,349	2,690	5,254	5,246	1,173	27,769	*124,693*	2,200
Commercial buildings	15,259	78,337	5,625	42,574	19,195	12,669	173,659	*791,526*	6.704
Federal government	271	935	493	129	1,781	437	4,046	*19,371*	.....
Unclassified	703	12,815	267	1,819	4,699	1,155	15,458	*120,444*	1,697
May, 1928	36,903	134,896	20,445	89,537	48,916	26,362	357,059	.....	13,329
April, 1928	17,018	114,380	24,780	73,765	41,813	30,972	302,728	.....	.....
May, 1927	19,268	77,056	7,352	82,547	63,239	35,818	285,280	.....	.....
Year to date, 1928	*102,471*	*552,507*	*109,729*	*338,891*	*211,169*	*135,815*	.....	*1,450,582*	*64,051*
Year to date, 1927	86,538	332,644	83,740	297,910	207,920	153,799	1,162,551	.....	37,592

electrical machinery alone and 78.4 per cent of the requirements of electrical machinery and apparatus combined, the smaller percentage in the latter instance being due to the enormous lamp trade carried on by the Netherlands and the French trade in insulators and cables. The countries entering definitely into the field of international competition are Great Britain, the United States, Germany, Switzerland and Sweden.

The following table gives a comparison of the values of the exports of electrical machinery and apparatus from the five principal industrial countries during the years 1913, 1923 and 1924.

Details of power supply and industrial conditions are given for the fourteen countries comprising western Europe in trade information bulletin No. 547, issued by the electrical equipment division of the Bureau of Foreign and Domestic Commerce, Washington, D. C. In this bulletin reference is made to data published in the ELECTRICAL WORLD that industry in the United States is already electrified to the extent of 65 per cent. In Great Britain, Belgium, Czechoslovakia, Hungary and other countries the degree of electrification is much less. In Germany industry is electrified to the extent of 70 per cent.

VALUE OF EXPORTS OF ELECTRICAL MACHINERY AND APPARATUS FROM LEADING COUNTRIES

Exported from	1923	1923	1924
United States..	$28,200,000	$75,600,000	$81,000,000
Germany.....	77,000,000	69,300,000	69,300,000
Great Britain...	37,300,000	68,800,000	75,100,000
France.....	10,620,000	17,250,000	22,200,000
Switzerland....	6,050,000	9,610,000	10,240,000
Total.....	$159,170,000	240,560,000	257,840,000

Market Conditions

SALES of power equipment show an advance in New England. An outstanding order for motors amounted to $11,000. Buying of scheduled material and general supplies is steady. Refrigerating machinery sales are quite active. The volume of sales has been reduced in the Eastern district, but the prospects for increased industrial business are good. Important new plants planned include a power plant for a typewriter manufacturer in New England, at a cost of $300,000; an oil refining plant on Staten Island, to cost $10,000,000; another oil refining plant in Baltimore, at a cost of $1,000,000; additions to a wire plant in New Jersey, amounting to $100,000, and plant extensions by a shock absorber manufacturer in northern New York, amounting to $100,000. Wire and cable sales show a noticeable improvement and transformer orders have increased and are expected to continue at that rate for several weeks.

In the Southeast a large condenser order placed by a Carolina power company amounted to $325,000. An oil circuit breaker order in immediate prospect will amount to $100,000. Industrial plant business is steady. An improved tone is reported in the St. Louis district with an increased demand for motors. Sales continue to improve in the Middle West. Orders placed by a central-station company for boilers, etc., amounted to more than $1,500,000. On the Pacific Coast apparatus sales, despite a 10 per cent increase in pumping motor business, are running somewhat less than those of last year. Distribution transformer business, however, is greater. Orders for equipment for the Northern Life Building in Seattle are placed at a cost of $200,000.

Metal Demand Active—Prices Stable

Non-ferrous metal prices are substantially stable with the exception of tin and silver, which are slightly lower. The demand in general has been good.

NEW YORK METAL MARKET PRICES

	June 13, 1928 Cents per Pound	June 20, 1928 Cents per Pound
Copper, electrolytic.....	14.525	14.525
Lead, Am. S. & R. price	6.30	6.30
Antimony.....	9.75	9¼
Nickel, ingot.....	35	35
Zinc spots.....	6.50	6.50
Tin, Straits.....	48	47
Aluminum, 99 per cent...	24.30	24.30

Base copper wire price June 20, 1928, 16¼ cents.

Though many of the copper producers are unwilling sellers, especially for early delivery, no attempt has been made to advance prices over the quotations of last week.

Improved Tone Noted in St. Louis District

Manufacturers report a much-improved tone in business in the St. Louis district. Orders for stock sizes of motors have almost doubled over those of the previous week. One order for motors ranging from 15 hp. to 35 hp. and amounting to $5,000 was placed and a local manufacturing concern purchased $3,000 worth. No large contracts have been closed, but several are being figured. There have been a number of good-sized shipments of transmission line material and a large volume of building materials is being sold. Construction projects are as follows:

The Citizens Electric Company, Hot Springs National Park, Ark., will make extensions in its power plant to cost $90,000. The Page Milk Company, Merrill, Wis., plans a plant a Coffeyville, Kan., to cost $200,000. The Gulf States Utilities Company, Beaumont, Tex., plans extensions in transmission lines, near New Iberia, La. The South Coast Company, Chicago, plans a sugar refining plant at Oaklawn, La., to cost $500,000. The Hillyard Chemical Company, St. Joseph, Mo., plans a plant to cost $100,000. The Gulf, Colorado & Santa Fe Railway, Fort Worth, Tex., plans locomotive repair shops at Saginaw, Tex., to cost $150,000.

The Texas Utilities Company, Plainview, Tex., plans rebuilding of transmission line from Plainview to Lockney, Tex., and extensions to South Plains to cost $90,000. The San Antonio Portland Cement Company, San Antonio, Tex., plans an addition to its power plant in the Lakeview district. The West Texas Utilities Company, Abilene, Tex., plans a 12,000-volt transmission line in Crockett County; and also will extend lines to the Rosser-Pendleton oil field.

Sales Volume Reduced in Eastern District

Actual commitments show a tendency to slacken in the Eastern district. The decline in activity is evidenced both with central station and industrial business. The latter looks favorable for an immediate revival, despite the usual seasonal decrease which is anticipated at this time of the year. A typewriter manufacturer in New England will build a power plant to cost $300,000; an oil refining company has authorized a plant on Staten Island to cost more than $10,000,000, while another company in this same line will build a plant at Baltimore to cost approximately $1,000,000. A wire company in New Jersey has approved an addition to its factory to cost $100,000, while a shock absorber manufacturer in northern New York will build an extension to cost a like sum. Control equipment sales are rather spotty. Cement mills and baking plants, two active outlets in recent weeks, have curtailed their inquiries, although it is believed to be only temporary.

Business in wire and cables shows noticeable improvement. Switching apparatus is operating under a reduced call, especially high-voltage, outdoor type apparatus, and no immediate renewal of demand is anticipated in that line until near the end of the summer season. Fractional-horsepower motor business has been extremely active in recent weeks and, while a temporary lull is evidenced, good sales are anticipated. Orders for transformers show an advance that is expected to last for several weeks. Sales of electric refrigerators are very strong. Construction activities are as follows:

The Northern Westchester Lighting Company, Ossining, N. Y., is building a substation at Ossining, N. Y., to cost $85,000. The Gulf Refining Company, New York, plans a refinery on Staten Island to cost $10,000,000. The Columbia Metal Box Company, New York, will build an addition to cost $100,000. The New York Edison Company, New York, plans a substation on West 56th Street. The Underwood-Elliott Fisher Company, New York,

plans a power plant at Hartford, Conn., to cost $300,000.

The duPont Cellophane Company, Buffalo, plans additions to its paper goods mill to cost $200,000. Beach Haven, N. J., plans an addition to its municipal power plant to cost $50,000. The Public Service Electric & Gas Company, Newark, N. J., has purchased 200 acres of land on Staten Island Sound, vicinity of Sewaren, N. J., for a new power plant at a later date. The H. F. Runkel Bakery, Elizabeth, N. J., plans a baking plant to cost $350,000 (this project was incorrectly attributed to the Ward Baking Company in these columns last week). The American Copper Products Company, Elizabeth, N. J., will build an addition to its wire-manufacturing plant to cost $100,000. The Radio Tube Company, Newark, N. J., will build an addition to cost $70,000. Harrisburg, Pa., will make extensions in its lighting system with the installation of 600-cp. units. The Youngstown Sheet & Tube Company, Youngstown, Ohio, will install a coal-washing plant at Nemacolin, Pa., to cost $600,000. The Asiatic Petroleum Company, New York, has acquired property at Baltimore, Md., for a proposed refining unit, to cost $1,000,000.

Sales Continue to Improve in Middle West

Business in most sections of the Middle West continues to show improvement and indications point to a continuation of this condition during the coming months. Reports from manufacturers of agricultural implements indicate an increase in the demand for farm machinery. Industrial activity is increasing and the steel and railroad industries continue to show improvement. Important orders placed by utility companies include three boilers complete with appurtenances valued at $1,000,000, labor and material to build foundations for a coal reclaiming structure valued at $60,000, a heating and ventilating system valued at $40,000, labor and material for erecting flues, uptakes, air ducts and appurtenances valued at $115,000, one 300-kw. electric mule complete with appurtenances and "Mazda" lamps valued at $90,000. Construction projects are as follows:

The Commonwealth Edison Company, Chicago, plans an addition to substation on Lake Street. The Illinois Steel Company, Joliet, Ill., is planning expansions to cost $200,000. The Delco-Remy Corporation, Anderson, Ind., plans an addition to its starting and lighting equipment plant to cost $100,000. The Electric Shovel Coal Corporation, Clinton, Ind., plans an electric mining plant and tipple at Winslow, Ind., to cost about $100,000. The Marshalltown Trowel Company, Marshalltown, Iowa, plans an addition to cost $120,000.

The Municipal Utilities Company, Des Moines, Iowa, plans a power plant at Missouri Valley, Iowa, to cost $225,000. The Briggs Manufacturing Company, Detroit, plans an addition to its automobile body plant, to cost $500,000. The Michigan Public Service Company, Ludington, Mich., has acquired the Antrim Light & Power Company, Mancelona, Mich. The Fisher Body Corporation, Pontiac, Mich., plans an addition to cost $1,000,000. The Ohio Electric Power Company, Sidney, Ohio, plans an automatic power substation at its Mill Road plant, Ravenna, Ohio, to cost $50,000. The Minnesota Power & Light Company, Duluth, Minn., will make extensions in transmission lines near Duluth, Minn.

The Nebraska Power Company, Omaha, Neb., plans extensions in transmission lines near Omaha, Neb., to cost $350,000. The Otter Tail Power Company, Fergus Falls, Minn., plans extensions in transmission lines near Montpelier, N. D. The Central West Public Service Company, Omaha, Neb., will build a transmission line from Edmore to Lakota, N. D. The Northern States Power Company, Eau Clair, Wis., plans extensions in transmission lines at Summer, Wis. The Wisconsin Power & Light Company, Madison, Wis., will build a 66,000-volt transmission line in the Iron River district, Mich., and the Wisconsin Lake territory, about 70 miles to cost $250,000. Lake Forest, Ill., Marquette, Mich. and Coleraine and Mankato, Minn., plan ornamental lighting systems.

Apparatus Sales to Date Below Last Year on Pacific Coast

Apparatus and machinery sales on the Pacific Coast, despite a 10 per cent increase in pumping motor business, are running somewhat less than those of last year. The exception is distribution transformers. One manufacturer reports transformer orders aggregating 400 units during the past week with an upward trend. Orders for equipment for the Alameda Estuary tube have amounted to $34,000. An electrical contract for the Capwell department store in Oakland has been let at a cost of $165,000 to the Nepage-McKenny Company. Power company purchases have included $4,500 worth of hardware and also a carload of bolts and screws, two carloads of poles and four 1,667-kva. transformers for the Modesto irrigation district. Interesting industrial orders include a dynamometer equipment for $6,000 for testing gas engines, two motion-picture motor-generator sets at $2,500 each, a 125-hp. synchronous motor valued at $2,700 for a cement plant and three 200-kva. transformers amounting to $3,500 for a steel plant. Street-lighting projects and orders are many and total $62,000.

An average week of motor and apparatus sales involving about 80 machines, from 30 hp. down, for irrigation, orchards, cold storage plants and lumber mill replacements, was reported in the Puget Sound district. An order for equipment for the Northern Life Building in Seattle amounted to $200,000. The city of Seattle has authorized the reconstruction of the Cedar Falls transmission line No. 1 by increasing the size of the conductors and installing new wire at a cost of approximately $100,000. Proposed industrial projects are as follows:

A cold storage plant at Wenatchee, Wash., to cost $60,000. A milk evaporating plant at Sunnyside, Wash., to cost $50,000. A cold storage plant at Clarkston, Wash., to cost $80,000. A large addition to the Fidalgo Pulp and Paper mill at Anacortes, Wash. A 22,000-volt line extension from Reedsport to Coosbay, costing $40,000. The superintendent of the U. S. Indian School at Phoenix, Ariz., is asking bids until July 10 for seven motors. The Los Angeles Compress & Warehouse Company, Los Angeles, plans an addition to cost $500,000. The Modesto irrigation district, Modesto, Calif., will receive bids until July 2 for high-voltage power transformers, 1,667 kva., outdoor type (Specifications No. E-11).

The Pacific Gas & Electric Company, San Francisco, has approved a fund of $278,000 for a substation at San Jose, Calif. The Great Western Power Company, San Francisco, will build a steam power plant at South San Francisco to cost $3,000,000. The West Stanislaus irrigation district, Westley, Calif., is asking bids until July 14 for seventeen electric-operated pumping units, six outdoor switching stations, and eighteen transformers. The Pacific Lighting Corporation, San Francisco, will make extensions in systems at Beaumont, Hemet and San Jacinto, Calif., to cost $50,000. The Astoria Box & Paper Company, Astoria, Ore., plans a pulp mill to cost $400,000. Ellensburg, Wash., will soon take bids for extensions to the municipal power plant, for which a fund of $35,000 has been approved. The Seattle Pulp & Paper Mills, Inc., Seattle, Wash., plans a mill to cost $1,000,000, including a power plant.

Power Equipment Sales Advanced in New England

Motor sales and control equipment orders have increased in New England. An outstanding order for a number of motors, amounting to about $11,000, was received, as well as an order for twelve motors for a complete installation for a paper mill. One manufacturer reports a number of interesting group orders for small motors. No let-down in the buying of scheduled materials and general supplies by central-station companies is apparent. Orders for small switches, watt-hour meters and power control equipment were numerous. A line material order totaling four carloads was reported. Refrigerating machinery sales are quite active. The demand for electric heating furnaces is continuing, with encouraging prospects of little abatement this season as compared with other years. Construction projects are as follows:

The Ames Shovel & Plow Company, North Easton, Mass., will build a new plant. The People's Hydro-Electric Vermont Corporation plans a development on the Green River to cost $163,000. The Farrell Foundry & Machine Company, Waterbury, Conn., will build an addition to cost $100,000. Boston, Mass., will expend $125,000 for a traffic control system. The Bureau of Supplies and Accounts, Washington, D. C., will receive bids until July 3 for electric pumps and spare parts for Boston navy yard and other yards (Schedule 9261). The American Writing Paper Company, Holyoke, Mass., will make extensions in its mill to cost $500,000. The Public Electric Light Company, St. Albans, Vt., plans extensions in its plants to cost $40,000.

Large Condenser Order Placed in Southeast

The outstanding order placed in the Southeast was by a Carolina power company for condensers for two 60,000-kw. turbines, amounting to $325,000. An oil circuit breaker order approx-

imating $100,000 is in immediate prospect in another section of the territory. A power company in Mississippi ordered power transformers amounting to $30,000, while copper wire orders of a Georgia company totaled in excess of $15,000. Other central-station orders included $3,500 worth of distribution transformers, $2,200 worth of bushings and insulators, $2,400 in small switching equipment and $1,500 in creosoted pine poles.

Engineering contracts have been let on a paper mill to be constructed in Alabama and wiring materials amounting to $40,000 will be used. An order was placed for motors, switchboards and lighting transformers amounting to $40,000 for textile mill units being moved from the East to Alabama. Another textile plant in the same state placed an order for a 1,500-kw. turbine. Electric welders were ordered by two small iron works in Georgia. A town in Georgia let a contract for 113 additional "white-way" standards. Another municipality ordered one carload of creosoted pine poles, while a third purchased wiring materials amounting to $500 for use in its fire alarm system. An order for $2,500 worth of wiring materials for a hotel job in south Georgia was placed by a contractor. Construction projects are as follows:

The Gulf Utilities Company, New Port Richey, Fla., has acquired the Cedar Keys Light & Power Company, Cedar Keys, Fla. The Florida Public Service Company, Orlando, Fla., is arranging for the purchase of the municipal power plant at Mount Dora, Fla. The Mississippi Power & Light Company, Jackson, Miss., is arranging a fund of $350,000 for 110,000-volt transmission line. The Duke Power Company, Charlotte, N. C., has acquired utilities in Lenoir and Morganton, N. C. The Capital Granite Company, Oxford, N. C., will build an electric-operated stone-crushing plant at Blairs, S. C., to cost $100,000. Mobile, Ala., plans an ornamental lighting system to cost $200,000.

Activities of the Trade

Brown Boveri Plans Sale of Part of Holdings

A special meeting of holders of founders' stock has been called by the American Brown Boveri Electric Corporation for June 25 at the office of the corporation, 420 Lexington Avenue, New York, for the purpose of voting and taking action on the sale of the entire stockholdings in the Moloney Electric Company, St. Louis. In a letter to its stockholders the company states that the sale is for cash and is recommended by the board of directors in view of present conditions in the industry and as the corporation may itself now engage in transformer manufacture at space already available for that purpose at its Camden, N. J., plant, thus avoiding duplication. The Moloney holdings will be sold to Stifel, Nicolaus & Company of St. Louis. There also will be submitted at the same meeting of holders of founders' stock the proposed sale of its shipbuilding business at Camden, a matter which the management has had under consideration for some time, believing the best interests of the corporation indicate that its activities be concentrated upon its electrical business alone. The sale will include that part of the plant known as the "North Yard" and parts of the "South Yard" particularly involved in shipbuilding. The consideration proposed is cash under circumstances that will insure the retirement of the present bond issue and a cash balance in addition. If approved by the stockholders the sale will be made as soon as the proposed purchaser can complete his financing.

W. M. Flook, chairman of the board of directors of the company, in commenting on the proposed sale to a representative of the ELECTRICAL WORLD, said that it will put the company in a stronger and better position than ever before. If the sale of these two holdings is approved by the holders of founders' stock the subsidiaries of the Brown Boveri corporation will consist of the Condit Electric Manufacturing Corporation of Boston and the Scintilla Magneto Company of Sidney, N. Y.

Robbins & Myers Company Reorganizes

Robbins & Myers, Inc., Springfield, Ohio, successor to the Robbins & Myers Company, manufacturer of electric motors, generators and fans, announces the purchase of all of the assets of the Robbins & Myers Company, including the Robbins & Myers Company of Canada, Ltd., from W. J. Myers, receiver. The new company states that it is in a position better to serve its customers than ever before, with ample working capital amounting to over $2,000,000 in quick assets and less than $50,000 of accounts payable. The capital structure of the new company will consist of 100,920 shares of $25 par value 6 per cent preferred stock and 151,380 shares of no-par common authorized.

The officers of Robbins & Myers, Inc., are W. S. Quinlan, president; C. A. Stirling, vice-president and general sales manager; O. C. Burmeister, secretary; H. I. Smeltzer, treasurer, and W. M. Mumma, fan sales manager. All of the above have been connected with the old Robbins & Myers Company and no change in personnel is contemplated. It is understood that Wilbur J. Myers will become permanently identified with the new company as one of the principal executives as soon as he is relieved of his duties as receiver.

THE WHEELER INSULATED WIRE COMPANY, Bridgeport, Conn., manufacturer of lamp cords and fixture wires, announces the appointment of the Burg Electric Sales Company, 32 Union Square, New York City, with a branch office at 1321 Arch Street, Philadelphia, as selling agent in the territories covered.

THE COMBUSTION ENGINEERING CORPORATION, International Building, 200 Madison Avenue, New York City, announces the appointment of James Cleary as general sales manager. Since associating himself with the company in 1921, Mr. Cleary has been district manager of the Philadelphia and Detroit offices and for the past two years has been assistant general sales manager.

THE EDWIN L. WIEGAND COMPANY, 422 First Avenue, Pittsburgh, manufacturer of electrical heating units, announces that George Bray & Company, Leeds, England, have purchased the rights to the "Chromalox" line of heating units for Great Britain and other European countries. George Bray & Company are manufacturers of ceramic products, especially refractories for gas burners and electric heating units of the open coil type, and will manufacture the "Chromalox" products in their own plant at Leeds.

THE JAMES R. KEARNEY CORPORATION, 4224 Clayton Avenue, St. Louis, manufacturer of overhead and underground utility equipment, announces a price reduction on solderless service connectors and guy wire clips. The company also announces the manufacturing of the Kearney "Hi-tension," four-in-one expansion anchors made in four sizes.

THE HOOVER COMPANY, North Canton, Ohio, manufacturer of vacuum cleaners, announces that it has placed on the market a new model 972, heavy-duty electric cleaner which is said to have a very large dirt-removing capacity. The company also announces that it is now equipping Hoover models 700, 543 and 972 with a new cord-strain-relief plug made of bakelite,

THE WELSBACH STREET LIGHTING COMPANY OF AMERICA, the WELSBACH ELECTRIC STREET LIGHTING COMPANY and the PENNSYLVANIA GLOBE COMPANY announce the removal of their general offices to 261 North Broad Street, Philadelphia, Pa.

THE MOGADORE INSULATOR COMPANY, Mogadore, Ohio, manufacturer of electrical porcelain, announces the removal into its new factory at Akron, Ohio, and a change of its name to the Akron Porcelain Company. There has been no change in the personnel or status of the company.

New Equipment Available

Three-Element Watt-Hour Meter

The type OB three-element watt-hour meter has been placed on the market by the Westinghouse Electric & Manufacturing Company. This meter is designed primarily for use on three-phase, four-wire circuits where a high degree of accuracy in measurement is desired. In construction the meter consists essentially of three single-phase elements placed one above the other, having all three disks mounted on a common shaft. The torques of all three elements are totalized and the energy measured on one register. The elements each have adjustable power-factor loops and are fully compensated for variations in temperature. The entire meter element is a unit assembly and can be removed from the case without affecting the calibration. The meters are made for either house type or switchboard mounting.

Dynamic Balancing Machine

An improved model of the Olsen-Lundgren centrifugal dynamic balancing machine has been placed on the market by the Tinius Olsen Testing Machine Company, Philadelphia. The supports for the rotor to be balanced are of the ball-bearing roller type and are provided with a ball-bearing support so that each bearing may oscillate freely to obtain correct alignment in supporting the rotor. A new type of coupling also has been developed, incorporating a ball-bearing universal joint instead of the former driving pins. This arrangement has the advantage that any ordinary misalignment between the spindle and the piece tested does not interfere with the accuracy of the reading.

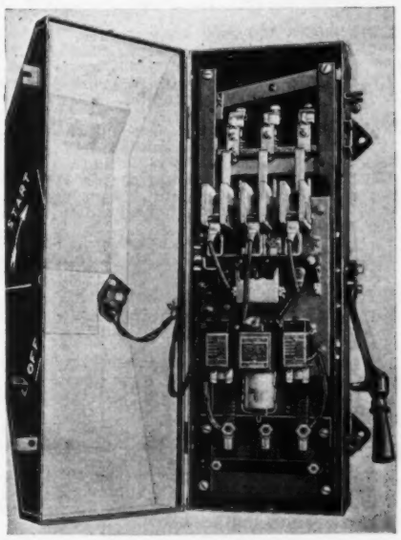
The rotor being tested can be quickly disengaged from the adapter and the time required to mount the part to be balanced is also reduced to a few seconds. The supports for the rollers can be readily adjusted to various lengths. Each one is provided with a quick-locking mechanism to facilitate taking the reading of unbalance at either bearing, so that the one support will be entirely free from the other in taking the readings.

To transfer the amount of unbalance and angle as shown by the machine so that corrections may be made at any two points along the length of the rotor, an entirely new transfer instrument has been developed. The correct reading of the amount of unbalance in ounce-inches, and the angular plane of unbalance required at selected points of correction from readings taken at the bearing support are readily obtained through simple adjustment. Where work is of a production character the settings are simplified further.

The improved dynamic balancing machine is available in any desired size suitable for balancing very small rotors of ½ lb. in weight up to the largest size turbine rotors. It is made to suit different lengths and classes of work and any special graduation other than ounce-inches can also be furnished on the dial and instrument. The wiring of the machine is entirely self-contained, and is piped so that no additional outside wiring is required.

Combined Resistance and Transformer Starter

The "Resisto-Transformer" starter, which is said to combine the features of both the primary resistance starter and the auto-transformer for reducing the



Motor starter combining the primary resistance and auto-transformer principles

starting current taken from the line, has been developed by the Allen-Bradley Company, Milwaukee. The transformer is connected to the line through graphite compression resistors, the resistance of which is gradually reduced until the motor starts. The transformer, which up to this point has been connected in open delta, is disconnected at the common point, leaving the motor connected to the line through the graphite compression resistors and the impedance of the transformer. The next step connects the motor through the running switch to the line and the final step disconnects the transformer altogether from the line. The manufacturer states that the second current inrush is limited to a value which can do no harm to the line voltage because the motor is not disconnected when switched to line voltage. The company claims that it is possible with this new starter to install squirrel-cage motors on power lines which otherwise could not handle them without costly additions in line and transformer capacity to prevent voltage fluctuations.

Control for Automatic Arc Welding

An improvement in the control equipment used with its automatic arc welding heads, by means of which the feed of the electrode wire is stopped a short time before shutting off the welding current at the end of the weld, has been developed by the General Electric Company. This is said to clear the electrode from the weld and to fill in the crater which is inevitably left at the end of the weld when the arc is cut off short. According to the manufacturer, it is always desirable to have the electrode clear of the weld when removing the work from the clamping fixture, to prevent the end of the wire from dragging. This is of particular importance with large sizes of wire. Many users of arc welding also want to eliminate the undesirable crater, as they find its presence is objectionable, especially on circular welds of small diameters where one end of the weld is lapped over on the other end.

The General Electric control panel for its automatic arc welding heads is controlled by a push-button station. Mounted on the panel are a line contactor of suitable size for the welding current, an arc voltage regulating relay, a relay for controlling the travel motor and a time delay relay for clearing the electrode from the weld. The rheostats for controlling the arc voltage and the speed of the electrode motor are mounted on the outside of the sheet metal inclosing case. A small meter panel is used for indicating the arc voltage and welding current.

PLATING TANK RHEOSTAT.—An improved type of plating tank rheostat, known as the "Optimus," has been developed by the Hanson-Van Winkle-Munning Company, Matawan, N. J. These rheostats are said to afford absolute regulation and control of plating baths. It enables the electroplater to adjust the total resistance of a plating tank circuit so as to regulate the current density in the plating bath itself.

RAILWAY SIGNAL CHOKE COILS.—A new choke coil, recommended for use with all high-voltage lightning arresters when used for the protection of transformers on railway signal high-voltage power lines, is announced by the General Electric Company. This choke coil is designed for location between the arresters and the apparatus to be protected, so that an incoming surge will first meet the arrester and then the choke coil. As the current requirements in such service are unusually small, it was found possible to utilize galvanized iron wire as the conductor in the coil without sacrificing efficiency.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 29, 1928)

1,671,236. TOY RAILROAD-TRACK SWITCH; A. H. Gill, West Haven, Conn. App. filed March 16, 1927.

1,671,245. ALTERNATING-CURRENT RECTIFIER; F. Kraus, Rodenkirchen, near Cologne, Germany. App. filed April 15, 1926. Using a tuned spring set in synchronous vibration by an alternating current magnet.

1,671,247. CURRENT RECTIFIER; L. Levy, Paris, France. App. filed Oct. 28, 1925. For wireless telegraphy and telephony and other analogous uses.

1,671,262. SUBMARINE SOUND RECEPTION; R. L. Williams, Newton, Mass. App. filed April 2, 1925.

1,671,269. ELECTRIC SWITCH; C. W. Bassett, Maplewood, N. J. App. filed Oct. 31, 1923. Rapid make and break.

1,671,294. SWITCH; L. Kellner, Chicago, Ill. App. filed April 27, 1925. Snap switch for lighting circuits.

1,671,300. ELECTRICAL HEATING APPARATUS; A. S. Macdonald, Great Neck, N. Y. App. filed May 17, 1923. Treating small objects such as steel balls for bearings.

1,671,335. STORAGE-BATTERY SEPARATOR AND PROCESS OF PRODUCING THE SAME; T. A. Willard, Cleveland Heights, Ohio. App. filed May 28, 1921.

1,671,337. SOAKING PIT; T. F. Baily, Alliance, Ohio. App. filed March 5, 1925. A soaking pit or furnace adapted to receive ingots or other articles to be heated in spaced upright position, the heating elements being located above the upper ends of the ingots whereby the heat is radiated downward.

1,671,344. SOLDERING IMPLEMENT; C. M. Chapman, Terryville, Conn. App. filed March 25, 1926.

1,671,378. ELECTRIC HEATER; F. D. Pitt, Kansas City, Mo. App. filed June 7, 1926. Bowl radiating type.

1,671,379. ROTARY SWITCH; R. K. Winning, Milwaukee, Wis. App. filed July 16, 1924.

1,671,394. ELECTRIC HEATER; E. E. Anderson, Kansas City, Mo. App. filed March 2, 1925. Bowl type.

1,671,401. EXTRUDED DEPOLARIZING BOBBIN; A. J. Briggs, Syracuse, N. Y. App. filed Mar. 31, 1922. For electric cells.

1,671,407. CONNECTER FOR USE IN CHARGING BATTERIES; A. O. Codney, Cleveland, Ohio. App. filed Dec. 18, 1925.

1,671,417. WELDING ROD; R. Franks, Elmhurst, N. Y. App. filed Jan. 21, 1926.

1,671,451. ELECTRIC VACUUM FURNACE; M. D. Sarbey, Cleveland, Ohio. App. filed Dec. 1, 1925.

1,671,461. ELECTRIC VACUUM FURNACE; G. D. Bagley, Great Neck, N. Y. App. filed April 28, 1927.

1,671,463. WATER-WHEEL REGULATOR; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 26, 1924.

1,671,469. ELECTRIC RESISTANCE; G. Egly, Berlin-Treptow, Germany. App. filed March 31, 1925. Terminal connection for resistor rods.

1,671,471. CIRCUIT INTERRUPTER; C. LeG. Fortescue, Pittsburgh, Pa. App. filed Jan. 3, 1920. Quick-acting.

1,671,473. ELECTRICAL INSTRUMENT; M. Jacobson, Camden, N. J. App. filed July 9, 1924. With increased sensitivity.

1,671,488. INDUCTION MOTOR; R. Rüdenberg, Charlottenburg, near Berlin, Germany. App. filed May 11, 1917. With increased starting torque while retaining good constant-speed characteristics and low starting current.

1,671,514. CONTROL SYSTEM; R. C. Deale and N. Marcalus, Plainfield, N. J. App. filed July 16, 1924. For operating machine tools.

1,671,533. BRUSH HOLDER FOR ELECTRIC MOTORS; J. Lindall, Boston, Mass. App. filed Jan. 21, 1927.

1,671,538. POTHEAD OR ELECTRIC DISTRIBUTING BOX; E. W. McIntyre, Cleveland, Ohio. App. filed March 11, 1927.

1,671,550. SAFETY-LATCH SPLIT ELECTRICAL PLUG; E. H. Semmens, Seattle, Wash. App. filed April 30, 1927.

1,671,566. DRY BATTERY; A. T. Baldwin, Montclair, N. J. App. filed May 31, 1923.

1,671,568. HEATING AND COOLING DEVICE FOR BUILDINGS; A. H. Barker, Westminster, London, England. App. filed Nov. 23, 1926.

1,671,584. ELECTRIC HEATING SYSTEM; W. W. Hicks, San Francisco, Calif. App. filed May 10, 1926.

1,671,591, 1,671,592. ELECTRIC HEATER; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. Apps. filed March 10, 1924, and Dec. 17, 1925.

1,671,593. TEMPERATURE-CONTROL SYSTEM; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed March 5, 1927.

1,671,615. ELECTRIC SWITCH; H. A. Spahr, Milwaukee, Wis. App. filed Nov. 24, 1926. For elevator use; actuated by a cam.

1,671,622. BOX AND METHOD OF MANUFACTURE THEREOF; W. A. Wilcox, Seattle, Wash. App. filed Sept. 8, 1925.

1,671,640. ELECTRICAL ATTACHMENT DEVICE; W. F. Hendry, Ossining, N. Y. App. filed Jan. 7, 1924.

1,671,641. CONTROLLING ELECTRIC MACHINES; H. S. Holmes, New York, N. Y. App. filed March 21, 1925. For electric resistance welding.

1,671,659. MEANS FOR PROTECTING AERIAL CABLES; T. Varney, Sewickley, Pa. App. filed Feb. 25, 1927.

1,671,742. ELECTRIC KILN; T. C. Prouty and W. O. Prouty, Hermosa Beach, Calif. App. filed June 27, 1927.

1,671,767. SUPPORT FOR OUTLET BOXES AND THE LIKE; J. Kozelka, Cleveland, Ohio. App. filed Jan. 2, 1926.

1,671,794. RESISTOR AND SUPPORT THEREFOR; D. L. Summey, Waterbury, Conn. App. filed June 5, 1926.

1,671,799. BRAKE-CONTROLLED CIRCUIT CLOSER; G. J. Warndorf, Cincinnati, Ohio. App. filed Feb. 18, 1926.

1,671,805. PROJECTOR LAMP; P. R. Bassett, Brooklyn, N. Y. App. filed Nov. 25, 1922.

1,671,824. ELECTRIC SWITCHBOARD AND TEMPLATE STRUCTURE; J. W. Hooley, Larchmont, N. Y. App. filed Sept. 27, 1927.

1,671,837. ELECTRIC SWITCH; A. H. Nero, New Britain, Conn. App. filed Jan. 30, 1922. For controlling lighting systems.

1,671,839. INDUCTIONAL WATER HEATER; F. C. Owen, Fayetteville, N. C. App. filed Oct. 28, 1926.

1,671,842. BATTERY-CHARGING CLIP OR CONNECTER; G. Schurimann, Seattle, Wash. App. filed Sept. 22, 1926.

1,671,860. ELECTRIC SWITCH; O. Hammerstrom, Bridgeport, Conn. App. filed Nov. 4, 1924. Snap switch mechanism as in a socket.

1,671,905. ELECTRICAL TERMINAL; E. D. McKenna, New York, N. Y. App. filed Oct. 3, 1924.

(Issued June 5, 1928)

1,671,963. INDUCTION REGULATOR; D. L. Alexander, Chevy Chase, Md. App. filed Oct. 2, 1926.

1,671,965. ELECTRIC SWITCH; G. R. Brown, Croydon, near Sydney, New South Wales, Australia. App. filed Aug. 31, 1926. Pull cord.

1,671,970. LIQUID RECTIFIER; G. W. Carpenter, Palo Alto, Calif. App. filed June 7, 1921.

1,671,979. WIRE SPLICE; W. E. Cook, New York, N. Y. App. filed Nov. 27, 1925. For use during the manufacture of insulated conductor wires.

1,671,985. THERMOSTATIC SWITCH CONTROL; J. C. Goosmann, Peoria, Ill. App. filed March 3, 1921.

1,671,993. FUEL-OIL PREHEATING DEVICE; J. T. McTarnahan, Boston, Mass. App. filed Aug. 21, 1922.

1,672,005. ELECTRICAL APPARATUS; A. J. Sorensen, Wilkinsburg, Pa. App. filed June 25, 1927. Railway signal equipment.

1,672,049. ALTERNATING-CURRENT RELAY; M. L. Almquist, Brooklyn, N. Y. App. filed March 29, 1926.

1,672,059. INSULATOR; W. S. Cook, Parkersburg, W. Va. App. filed Oct. 9, 1923. Pin type insulators.

1,672,067. GROUNDING RECEPTACLE AND PLUG; P. F. Labre, Spalding, Mich. App. filed May 12, 1927.

1,672,085. SIGNAL; G. A. Primrose, Oakland, Calif. App. filed March 27, 1922.

1,672,112. MEANS FOR FACILITATING STARTING OF AUTOMATIC GENERATING PLANTS; A. F. Brotz, Kohler, Wis. App. filed Dec. 30, 1921.

1,672,201. TERMINAL CONNECTER FOR ELECTRICAL SUPPLY CABLES; A. Champion, Flint, Mich. App. filed May 18, 1921.

1,672,219. SWITCH RECEPTACLE; H. Hubbell, Bridgeport, Conn. App. filed Dec. 30, 1925. For use in wall outlet box.

1,672,221. ELECTRIC HAMMER; J. Karcevsk, Chicago, Ill. App. filed April 25, 1927.

1,672,261. FUSE; G. Kahn, Chicago, Ill. App. filed Oct. 1, 1927. Renewable plug fuse.

1,672,263. SECTIONAL SWITCH BOX; E. H. Kruse, Fort Wayne, Ind. App. filed March 22, 1923.

1,672,285. GASEOUS CONDUCTION LAMP; F. Schaefer, Kalamazoo, Mich. App. filed Aug. 27, 1927.

New Trade Literature

LAMPHOLDERS.—The General Electric Company, merchandise department, Bridgeport, Conn., is distributing a pamphlet covering a line of new threaded catch "Textolite" lampholders.

BUS SUPPORTS.—The Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, has issued bulletin No. 31-BA, describing a new line of low-voltage bus supports for voltages from 200 to 4,500.

SWITCHES AND WIRING DEVICES.—The Hart & Hegeman Manufacturing Company, Hartford, Conn., has issued catalog T describing its complete line of "H & H" fine switches and wiring devices. Many illustrations showing the various types of the equipment are included.

STARTERS AND SWITCH. — Bulletins Nos. 111, 112 and 113 issued by the Clark Controller Company, Cleveland, describe respectively the Clark "Three C" primary resistor starters, the Clark "Three C" across-line-type reversing starters and the Clark "Three C" starting switch with disconnect feature. The bulletins contain dimension diagrams and ratings.

CONDUIT FITTINGS. — The Adapti Company, 2996 East 72d Street, Cleveland, has issued catalog No. 107-A, a supplement to catalog No. 107, describing and illustrating the company's new line of Adaptilets, also fixture elbows, plug and base receptacles and self-aligning fixture joints for use with Adapti-lets, Adaptiboxes and all regular standard fittings.

ELECTRIC FANS. — Robbins & Myers, Inc., Springfield, Ohio, is distributing bulletins No. 1386 and No. 1387 describing and illustrating its alternating and direct-current circuit ceiling fans built with lighting units. These fans are especially suited for hotels, office buildings, churches, theaters, restaurants, stores and homes.

DEMAND REGISTER.—Bulletin No. 75 issued by the Sangamo Electric Company, Springfield, Ill., describes and illustrates the Sangamo type HB maximum demand register. The bulletin contains instructions for installing and operating the register, as well as other information in regard to it.

SWITCHBOARD DEVICES.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-924, GEA-938 and GEA-942 covering respectively its bus supports for indoor service, accessories for switchboards and miscellaneous air break switches, plugs and receptacles.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Berlin, Germany (No. 31,534), for motor-driven household electrical appliances, and another (No. 31,537) for household electrical appliances and motor-driven devices.

An agency is desired in Leipzig, Germany (No. 31,530), for electric refrigerators, and another (No. 31,535) for all-metal electric washing machines.

Purchase is desired in Bradford, England (No. 31,527), of electric traffic control devices.

An agency is desired in Dresden, Germany (No. 31,529), for electric washing machines.

An agency is desired in Warsaw, Poland (No. 31,565), for wiring supplies and fixtures.

Purchase is desired in Auga Prieta, Mexico (No. 31,556), of X-ray and electromedical equipment.

An electric power station is being planned to be built at Bohult, about 2 miles from the present junction of the tributary and the main river, and will have a capacity of 100,000 hp. Additional information is available under reference Sweden No. 276,297.

A company is being organized in Oswiecim (Teschen, Silesia) for the utilization of water power on the Sola River. The company's intention is to build a hydro-electric plant which will furnish the current for operating a normal-gage electric railway to be constructed between Oswiecim and Zywiec.